Data on Grain Elevator Loads—Lighting in Automobile Factories—
AIEE Proceedings and the Regular Departments for Engineers and Central Station Managers

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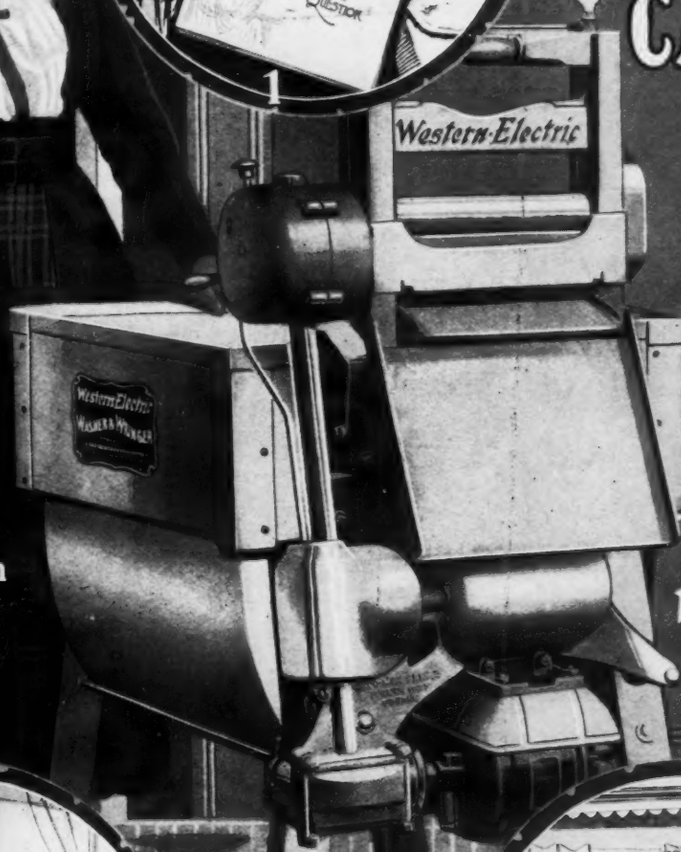

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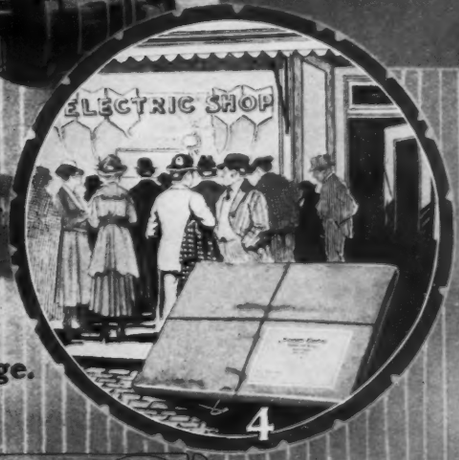

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Keeping Faith with the Public

RELATIONS between associated companies, the connection between a subsidiary operating property and a controlling holding corporation, are mysterious to the general public. They are open books to the state commissions. Those bodies have authority and usually the requisite training for analyzing the ramifications of intercorporate financing. Facts must appear in the accounts. Written on the books, they are subject to scrutiny to reveal entries prejudicial to consumers. Financiers do not always have the point of view of operating officials; they do not have the intimate touch with the public which the men at operating headquarters keep. They see a financing necessity which they would meet in a method perfectly legitimate for a private corporation, but open to question and criticism under the modern theory of regulation. In such cases the operating official should act. Speaking authoritatively from his greater knowledge of the quasi-public institution, he can show the new standards of financial exactness which the times demand, he can insist that the records shall not confront him in a future rate case with figures which undermine his argument.

Technical College Graduates in War Time

ONE of the first effects of the entry of America into the war has been the volunteering of the graduating classes, nearly en masse, throughout the country, into national defense service, with a considerable number of enlistments also in junior classes. This dedication of our trained youth for the maintenance of justice against brute-strength aggression is an admirable thing, and no one who believes in the ideals of young men will oppose it. It is important to remember, however, that injudicious dedication to the world's good may actually do the world harm, and well-intended action may by over-haste defeat its own purpose.

War is a vast country-wide engineering enterprise. Theoretically speaking, an all-wise and powerful board of experts should determine where each man and woman should be posted in the great war chain of fighters, for it is obvious that all specially trained men, and particularly all technically trained men, should keep at the posts where their training is needed. It was an inevitable mistake made by our allies at an earlier stage in the war which led many young physicians, engineers, mechanics and valuable specialists to rush as volunteers for the front. It may overtax human intelligence to decide whether any particular man of military age is more needed at the front or at the rear. Mistakes must occur, and many of them; but the technically trained men should be kept at their profession unless there happens to be a superfluity of them. So long as there are earnestness and determination to serve, they also serve who only stand and wait. The junior men in colleges, and particularly in technical or medical colleges, will probably serve their country better by working hard at their educational preparation than by abandoning their college work before their training is completed. In general, however, every day's work done in any sort of productive employment contributes to the war and therefore hastens the end of the war. To do any useful thing hard is to fight for the Allies.

"Business as Usual"

THIS is the slogan which is just now resounding through the country. It sounds well and is a very comfortable hypnotic for the considerable section of our people who still do not know that we are at war. Like many another epigrammatic phrase it is specious but somewhat delusive. One need only recall the indignation with which our British friends repudiated the notion that the war was going to make any particular difference with the orderly conduct of their commercial affairs. With four or five million men in the field they know better at the present moment, and are at last devoting all the energy of the nation toward the grim work in hand of making a way for the next generation to carry on "business as usual." The necessity of concentrating all possible energy on one deadly purpose has been driven home to the belligerent nations at awful cost, and it will be a sorry thing for us in America if we insist on learning only from our own bitter experience.

We are not disposed to be calamity howlers and to think that the country is going to the dogs from the very start, but if we travel on the theory that we can pursue the even tenor of our profitable way undisturbed by the greatest war that history has ever known we are due for a terrible awakening. This country is not going to go backward, grass is not going to grow in the streets, nor will the fields be given over to weeds and brambles. On the contrary, business has been so far from going on as usual of late among our allies that we shall have to strain every effort to keep them in supplies, as well as to reinforce, probably by several millions, their armies in the field. There will be no lack of work for every ready hand in these United States. It will be business—but not as usual, unless we choose to court disaster; business, rather, molded and directed to do the one thing needful for national salvation. A few far-seeing merchants have already sounded a warning and have begun to bear in mind the real needs of the

near future. Others, we are sorry to say, are trying to cajole themselves and the public into the notion that everything will go along swimmingly and that we shall never know the difference, living cheerfully along in our wonted way and taking no thought for the morrow.

As regards those lines of work in which our readers are particularly interested, there will be business enough, but it certainly will not be quite as usual. The central stations, as we have recently pointed out, will have their work cut out for them in trying to meet the needs of the hour. The amount of electrical equipment of various kinds which will be absolutely needed in carrying on the war ahead of us will keep factories in almost every line of electrical production as actively engaged as the coming scarcity of labor will permit. They will not only have more business, but more business than they can easily do, and before another year is past there will be need for every wheel that can turn and every man that can be found. There will be plenty of business—business enough for every man and woman whose services are not needed at the front or just back of it. But it must turn itself into new channels that are being laid out for it, and before the war is over it will be very far removed from "business as usual."

Earning Power of Electric Signs

VERY definite evidence of the real earning value of electric signs has been brought out in connection with the movement on some streets of a number of cities to do away with all overhanging signs. For example, one restaurant concern which operates a large number of restaurants having a very steady income credits quite definitely a certain amount of gross income per month enjoyed by a restaurant on a certain street to its overhanging electric sign. The absence of this sign, which could be seen from a distance down the street by strangers in the city or those not acquainted with the location of the restaurant, is said to have caused a definite decrease in gross earnings. While a popular-priced restaurant run by a concern of a national reputation may be the business which benefits the most from electric signs on the streets and can most easily measure the results, the benefit to other lines of business, if it could be accurately measured, would doubtless be found similar.

Insulation Characteristics of Cables

HIGH-TENSION aerial systems of transmission, with their towers and poles, are only possible, as a general rule, in open-country districts where the density of population falls below a certain value. In cities and in densely populated areas it becomes necessary to carry the power lines in cables underground. At the present time 25-kv. cabled systems have been developed in America, and yet higher voltages have been developed in Europe under the exigencies of the denser populations there. The problem of economic long-distance distribution of power in urban districts is therefore closely bound up with the development of high-tension cables.

A paper by W. S. Clark and G. B. Shanklin before the A. I. E. E. June meeting in New York discusses a large number of experimental tests on samples of high-tension cable under various impressed conditions as to temperature and voltage, but at constant frequency. As is well known, it is the duty of a self-respecting high-tension cable to keep cool throughout, under all normal conditions of service and demand. If a hot spot occurs, the dielectric losses accumulate at that spot and tend to make the temperature rise yet more. This, in turn, aggravates the losses; so that in this vicious circle a breakdown of the cable may soon occur.

The various curves indicate that in all the samples tested the power factor, the permittivity and the leakance all tend to get worse as the temperature rises. If, however, the working temperature of the cable can be kept normal, it is remarkable how permanent and safe such cables can be made.

Improvement of Insulators

THE Institute paper of W. D. Peaslee on the insulator situation will bear close study, particularly in its bearing on the composition of insulators as affecting their permanency. A few years ago attention was directed chiefly toward the production of insulators of correct design and general mechanical and electrical properties. That is, an insulator should not flash over at working voltages even when dirty and wet; it should not puncture on an accidental flash-over; it should not leak materially and should be mechanically strong. Now, particularly since the introduction of the suspension type, it has been mechanically easy to secure high-voltage insulators meeting these general conditions admirably. Experience has shown, however, that these superficial good qualities may not be permanent and that insulators which have passed all reasonable tests along these lines may fail in use or even in storage. Investigation of causes shows that at least four elements co-operate to produce deterioration—mechanical stress due to temperature change as between the metal, cement and porcelain, complicated by the effect of moisture on the cement; concentration of dielectric flux at particular points due to improper design or to coarse defects of the porcelain; similar flux concentration resulting from the fact that the porcelain, consisting of crystalline structures and binder, is far from homogeneous, and finally mechanical stresses due to difference of expansion between these two elements.

Careful and frequent testing of insulators in service helps to forestall failure, so that the service records of many high-voltage lines are exceedingly good. However, there is always left an element of uncertainty. The most obvious means of relief is in increasing the factor of safety in the insulators themselves. A factor of safety of four instead of two or less would certainly greatly increase the reliability of the system. Mr. Peaslee, however, brings up another matter of very vital interest, the substitution of fused quartz for

porcelain or glass. The remarkable qualities of this material are now well known from the standpoint of insulator manufacture, and it possesses the singularly valuable property of being successfully homogeneous so that the dangers due to long-continued internal minute stresses should be practically obviated. That fused-quartz articles can now readily be made on a large scale, provided that there is sufficient call for them, seems to be satisfactorily demonstrated, the only question being the cost at which the work can be accomplished. At all events, one thoroughly good insulator is worth the price of several moderately good or poor ones, and the experiment is extremely well worth trying as a measure of relief from difficulties which, while considerably reduced by improvements in porcelain manufacture, are still troublesome.

Electric Power for Grain Elevators

GRAIN elevators are scattered over the major inhabited portion of North America and they demand annually a very large amount of power. Unless electrically driven, this power means the consumption of fuel here, there and everywhere, in many cases where the freight rates are almost prohibitively high. The nature of the power problem is somewhat as follows: Grain finds its way from the farms to the primary elevator at the nearest available railway. This is generally a crude affair, taking the grain from the farm wagon into a hopper, lifting it into storage by a conveyor, and then dropping it by gravity into the cars as they are available. The power requirement here is of the simplest possible character. Troublesome details are involved, however, since the grain comes in irregularly but rapidly during the harvest season and then the plant lies in comparative idleness for the better portion of the year. The annual load factor of such an establishment is about as bad as can be imagined, but its maximum fortunately comes at a time when the lighting load at least is low.

Next comes the main elevator at the shipping center. Here the grain-laden cars are shunted onto an elevator siding and pulled in turn over the hoppers by a power-driven winch. Cable-operated drag shovels unload the grain into the hopper, under which is a belt conveyor which transfers the grain to the bottom of the "leg," where the chief elevating conveyor lifts the grain 150 ft. to 180 ft. to the top of the structure, where it is weighed and then passed on other conveyors to the storage bins. From the bottom of these still other conveyor belts take the grain from storage to the leg, thence to the scales, and finally by gravity into the car or steamship. This program of lifting and conveying is a considerable one, and in addition still more power is required for cleaning and handling the grain which passes out once more in much the same cycle as loading or unloading. Much of the work is rush work, calling for heavy output, since it is more important to load and release the cars or steamers quickly than it is to save a little on maximum demand. The conveyors must sometimes be started under full load. The work is very irregular, though with a better annual load factor than in the small elevators, and hence requires large motor capacity. F. F. Espenschied in this issue cites one typical elevator of a capacity of 3,250,000 bushels (1,145,746 hectoliters) which handled last year some 52,000,000 bushels (18,323,930 hectoliters) of grain going in or out. The plant was in operation for about 3500 hours during the year and evidently was filled and emptied approximately eight times. For this work motors of 2325 rated horsepower were needed and the consumption in kilowatt-hours was nearly 1,250,000, but the average load during the hours of operation was only about 20 per cent of the motor rating.

Despite these unfavorable load conditions and relatively high peaks, the power cost was barely over 40 cents per 1000 bushels (352.38 hectoliters). These figures show how economically the motor service does the work in spite of unfavorable conditions, and they are by no means the lowest figures cited in the paper before us. From the standpoint of the central station the grain elevator makes a useful summer load desirable in spite of its poor load factor. And because of that unfavorable condition the fuel demand of an elevator without electric drive is an item so big as to be well worth saving from the standpoint of conservation. Here is one more added to the long list of cases in which the central station can add to its profitable business and at the same time serve the community in lowered cost and in fuel and transportation saved.

The Coming Issues

IN THE issue of July 7 space will be given to articles of interest to officials who concern themselves with questions of public policy. Conditions which underlie the central station industry are undergoing radical change. To gage the effect of these conditions upon operating results is one of the most important responsibilities of managing executives. An article in the next issue will discuss this subject. Owing to the fact that only about 2 per cent of the sunlight which could enter a building if the roof were removed may penetrate many factories having lateral windows it is very essential that artificial light be provided. This condition is especially liable to exist in machine shops and foundries where the light may be absorbed by the black surroundings. In the next issue of the ELECTRICAL WORLD C. E. Clewell will point out some illumination requirements of such places and show how they may be fulfilled by artificial lighting. Many central stations may find at this time that they have to provide more steaming facilities and generating capacity and are handicapped by space limitations. In the July 14 issue will be explained how one company, which was fortunate in having stokers and boilers that could be forced to high ratings, overcame this difficulty. A particular feature of the following issue will be an article pointing out the shortcomings of existing equipment for outdoor switching and transformer stations and suggesting improvements that should relieve this situation very materially.

Power Requirements of Grain Elevators

Performance Data of Six Motor-Driven Terminal Grain Elevators at Port Arthur and Fort William, Ontario— Features of the Power Rates

BY F. F. ESPENSCHIED, M.E.

Assistant Engineer Hydro-Electric Power Commission of Ontario, Toronto

RELIABLE estimates on the total power used in handling the large grain crops of this continent are not readily available, but the aggregate power used for handling and cleaning must total many hundred thousand horsepower, as grain elevators are spread over practically the entire inhabited portion of North America. Much, if not all, of the power load represented is available for the local central stations. While many elevators are now operated with purchased power, their number appears relatively small, judging from visits to large grain centers and the data available in the technical press. In this article an analysis is made of grain elevator loads and some detailed data are submitted from actual practice.

In tracing the movement of grain from the farm to the mills the first elevator encountered is usually the small-town elevator adjoining the railway. Frame construction, sometimes covered with sheet iron, is generally used, and few refinements either in structure or in power application are present. Owing probably to the poor load factor (annual), the usual high cost of central-station power in such localities, and the fact that such elevators have often been built before the advent of modern central stations, most of the small-town elevators are operated by steam or gas engines. Some of the elevators are run in conjunction with a local feed and flour business using a grain grinder or chopper. The electric drive for such cases is very simple, consisting, as a rule, of a single squirrel-cage motor, or possibly two motors. Grain is unloaded from the farmer's wagon into a hopper and elevated to the bins, from which it flows by gravity through spouts to the car. Such elevators have probably the poorest annual load factor of all, since the rate at which grain comes in is greatly reduced once the local crop is harvested, and since there are long periods when no grain comes in. Only in a few instances is power needed for shipping.

Some of the grain goes direct to millers, but the bulk goes either to inland storage elevators or to the Great Lakes or ocean terminal elevators. Grain from the Northwestern States and Canada destined for Eastern cities or for Europe goes usually to one of the large lake terminals, such as Chicago, Milwaukee, Duluth, Port Arthur and Fort William, where the great storage and transfer elevators are situated.

To illustrate the power requirements of these terminals the grain movement will be followed from the time when a string of loaded box cars is shunted onto an elevator siding. The cars are "spotted" over the receiving hoppers by a wire cable operated from a drum. The grain is removed from the cars by drag shovels operated by power-driven cables. Under the receiving hopper is a horizontal belt which carries the grain to the "boot" or foot of a receiving "leg." This "leg" elevates the grain 150 ft. to 180 ft. (45.7 m. to 54.9 m.) into the weighing scale. From the hopper outlet of the scale belts carry the grain to storage bins. To load cars or a boat grain is drawn from the bottom of a storage bin onto a horizontal conveyor belt, then carried by an elevating "leg" to the scales, and thence by gravity into the car or boat, as the case may be. Cleaning and handling grain requires power also and in considerable quantities, the cycle of handling being practically the same as for loading or unloading.

Operating Difficulties

Economy of energy consumption is in many cases of secondary importance, speed in unloading grain being the principal requirement. This is true because cars must be released to the railways promptly, particularly

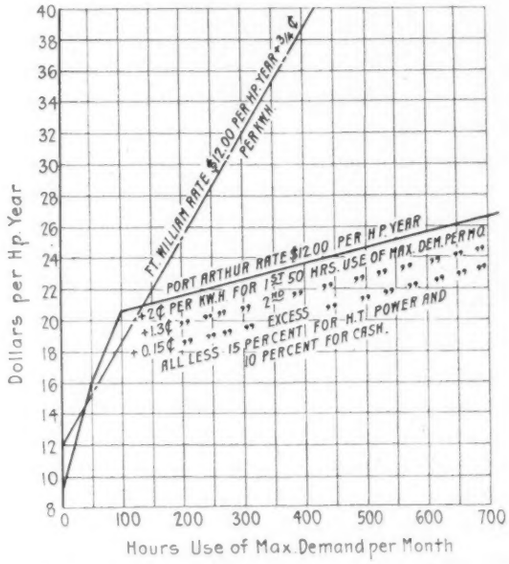
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FIG. 1—GRAPHICAL REPRESENTATION OF TWO POWER RATES FOR GRAIN ELEVATORS

during the fall grain rush, and because the fixed charges on steamers lying at dock are very high. A car of wheat containing, say, 1000 bushels (352 hectoliters) can be unloaded into storage with practically the same kilowatt-hours and about one-half the horsepower maximum demand in twenty minutes that would be required to do the same work in ten minutes. While slower operation on a maximum-demand rate will permit a considerable power saving, unfortunately the usual elevator manager cannot take advantage of it.

Few elevators work twenty-four-hour days, owing apparently to railway movements and labor difficulties. Night work appears to be more the exception than the rule, although during the rush season near the end of lake navigation elevators operate late into the night, or all night, to unload cars or load a boat. Meal hours are usually marked, however, by an almost complete cessation of work. These observations apply to Canadian practice, but are generally applicable elsewhere.

Belts and legs, or elevators, must sometimes be started fully loaded, and for this reason elevator designers and managers insist on ample power reserve. If an elevator is driven with individual motors over-motoring usually results when gaged by the usual industrial standards. Owing to this tendency and also to the fact that some motors must operate nearly without load for short periods the substation power factor is very poor (50 to 60 per cent frequently). Furthermore, the load is far from uniform, owing to the practice followed in unloading an entire car into a hopper before beginning to elevate the grain. With five hoppers on one track five leg motors are thus required to operate at the same time, giving heavy short peaks.

TABLE I—MOTOR EQUIPMENT OF PORT ARTHUR AND FORT WILLIAM GRAIN ELEVATORS (60-CYCLE, THREE-PHASE, 550-VOLT UNITS)

Service	Number and Hp. of Motors Serving Six Grain Elevators											
	G.C.		D.S.		P.A.		W.T.		CON.		G.T.	
	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.
Elevator Legs:												
Receiving	5	75	1	75	..	..	3	75	2	75	5	100
Shipping	5	100	1	100	..	..	3	75	4	60	5	100
Cleaner	5	50	2	25	5	50	2	60	1	40	5	50
Flax	2	50	1	25	..	..	1	15	1	15	..	..
Screenings	1	50	1	20	1	15	4	25	2	25	1	75
Oat	1	40	..	..	..	..	..	..	..	..	..	..
Dryer	1	30	1	25	..	..	1	20	..	..	1	25
Conveyor Belts:												
Cupola transfer	1	25	2	20	5	15	..	..	2	20	1	25
Cupola storage	5	25	2	30	5	25	5	20	1	7½	1	100
Receiving	5	10	..	..	..	..	..	..	1	40	..	..
Basement shipping	5	20	..	..	6	20	12	15	7	15	1	100
											1	35
Basement storage	5	15	1	15	6	15	1	15	..	..	2	30
											3	40
Basement storage	5	5	..	..	1	40	..	..	..	..	1	40
											2	25
Screenings	..	..	..	..	1	5	..	..	..	..	..	..
Miscellaneous:												
Screw conveyor	1	10	..	..	..	..	1	3	1	10	1	20
							1	7½				
Car puller	2	50	1	40	..	..	2	40	2	40	1	100
Car returns	1	5	..	..	..	..	*1	25	..	..	..	..
							*1	75	1	30	1	75
Car shovels	2	50	1	15	..	..	*1	30			1	40
Cleaners	5	30	2	10	1	75	10	10	4	15	5	40
Cleaners	2	15	1	10	1	40	3	7½	..	..	..	..
Cleaners	2	10	1	10	..	..	1	7½	6	10	..	..
Separators	..	..	1	20	1	10	2	5	1	2	1	7
Scalpers	..	..	..	..	..	..	1	10	*2	40	1	6
Exhaust fan	1	30	..	..	..	..	1	20	..	..	1	60
Dust collector	1	40	1	30	1	60	1	15	1	20	1	40
Dryer fan	1	100	1	40	..	..	..	..	..	..	1	25
Air compressor	..	..	..	..	..	..	..	..	..	..	..	..
Machine shop	..	..	..	..	..	..	..	..	..	..	1	5
Passenger elevator	1	10	1	7½	..	..	1	5	1	7½	1	10
Humphrey elevator	1	5	..	..	..	..	1	5	..	..	..	..
Fire pump	1	125	..	..	..	..	..	..	..	..	1	50
Totals, exclusive of fire pump	66	2345	22	602½	34	905	60	1415½	40	1037	45	2468

*Main shafts

To illustrate the character of load encountered in modern electrically operated elevators in Port Arthur and Fort William, Ontario, several typical charts are reproduced. These should be noted in connection with the data tabulated herewith. The periodic unloading peaks are especially noticeable in the G. C. elevator charts, where they indicate conditions with five unloading legs in use.

Elevator Equipment

Brief descriptions of the electrical equipment of the elevators referred to will serve to interpret the performance results indicated.

Elevator G. C. has a storage capacity in its workhouse of 500,000 bushels (176,192 hectoliters) and in its storage bins of 2,750,000 bushels (969,054 hectoliters), making the total storage 3,250,000 bushels (1,145,246 hectoliters). Energy is purchased from the city system (Port Arthur hydroelectric plant) at 22,000 volts, three-phase, 60 cycles, on a ten-year contract at standard high-tension rates. This elevator was built by the Barnett-McQueen Company of Fort William, Ontario, during 1912 and 1913 and is a typical modern terminal elevator. There are four unloading tracks, each with five unloading hoppers so that five carloads of grain may be unloaded and elevated at one time.

All the motor and substation equipment is Canadian Westinghouse make. Three 400-kva., 22,000/575-volt oil-insulated, self-cooled transformers and one spare are installed. To correct the power factor a 1000-kva., three-phase self-starting synchronous condenser is provided. Ample capacity allows for additions to the elevator and the avoidance of overheating, for experience in some elevators has shown the wisdom of not overtaxing the condenser.

In studying the operating data for the Port Arthur elevators, which data have been carefully kept and recorded monthly since the elevator began operations, it is necessary to consider the power rate. The features of the rate are as follows:

Service Charge—$1 per horsepower per month, based on the maximum ten-minute sustained demand plus consumption charges.

Consumption Charges—2 cents per kilowatt-hour for the first fifty hours' use of maximum demand per month; 1.3 cents per kilowatt-hour for the second fifty hours' use, and 0.15 cent per kilowatt-hour for all monthly consumption in excess.

Discount on total bill is 15 per cent for high-tension power and 10 per cent for prompt payment.

Minimum monthly horsepower demand is taken as not less than 75 per cent of highest peak previously recorded.

Power factor to be maintained at 92 per cent lagging. For low power factor accounts are corrected as follows: (Hp. demand × 92 per cent) ÷ actual power factor = hp. to be paid for.

No fixed increments are made for additional power taken; graphic records are used.

This rate is shown graphically in Fig. 1, which also indicates one rate charged in Fort William, where the usual increment is 50 hp. In connection with the Port Arthur rate it should be observed that after a customer's consumption exceeds the equivalent of 100 hours' monthly use of his maximum demand the increased cost is very slight. The same rate applies to low-tension power customers, except for high-tension discount, and automatically takes care of load factor. A rate similar to that shown for Fort William does not take into account high load-factor customers, so a different rate is necessary for each class of customer served.

Elevator P. A. has a total storage capacity of 9,250,000 bushels (3,259,546 hectoliters). Only part of the energy used is purchased from Port Arthur city system and that at standard high-tension rates. This elevator, which is a modern tile structure, consists of two separate workhouses and three large sets of storage bins. The elevator was built for shaft and rope drive from two steam engines, one rated at 650 indicated hp. and one rated at 1000 indicated hp. Owing to insufficient power, part of the elevator was electrically equipped, using group and individual drives. A small brick substation near one of the workhouses contains three 150-kva. oil-insulated, self-cooled transformers. A synchronous condenser made from a refitted alternator has given good service as a power-factor corrector.

The load factor is high and the load steady since the steam equipment drives the part of the system having the most fluctuating load. The operating data are of little value without complete steam costs, which are not available at this time.

Elevator D. S. has a total storage capacity of 1,750,-

000 bushels (616,671 hectoliters). Energy is purchased from the Port Arthur city system at standard high-tension rates. As this elevator has been operated as a hospital terminal since its erection, the operating characteristics are different from those of ordinary terminal elevators, which do little or no "doctoring" of grain; that is, grading and sorting. Data on the grain handled prior to 1916 are not available from this elevator. It may be noticed from the performance data that the load factor is quite high.

The substation contains three 150-kva. oil-insulated, self-cooled transformers and a 200-kva. synchronous condenser for power-factor correction.

Elevator W. T. has a total storage capacity of 2,000,000 bushels (704,767 hectoliters). Energy is purchased from the electric service company in Fort William at the high-tension rate of $25 per horsepower-year for half the maximum demand plus 1½ cents per kilowatt-hour for all excess consumption. This elevator is also a modern concrete terminal structure.

Elevators Con. and G. T. are also in Fort William and purchase all energy, the former at 2300 volts and the latter at 22,000 volts. Data which are omitted are not available.

OPERATING DATA

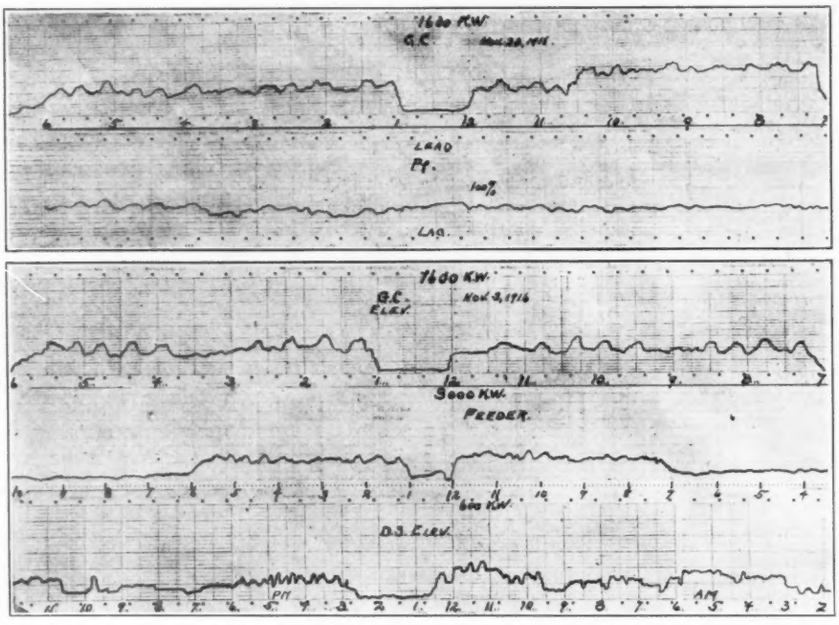
The operating results of six elevators have been carefully compiled and studied in an effort to obtain useful constants, but the results so far have been disappointing. The chief reasons are: (1) The energy and power required for terminal grain handling depend on the size of the grain crop and its general quality. Clean, dry grain requires less handling in the elevator. Cleaning and drying grain requires power in addition to that necessary for unloading and loading. (2) Railway and lake-boat operations affect the rate of grain receipts and shipments. (3) The skill and policy of the elevator management are important factors. Some managers sacrifice power for greater speed, and sometimes it is impossible to keep down the peak load despite every precaution. Naturally the highest power demand occurs when the elevator is performing its three chief functions of receiving, cleaning and shipping at the same time. Conditions sometimes occur which make it necessary to continue cleaning when the other two processes are being carried on, although as far as possible this combination is avoided.

INTERPRETATION OF PERFORMANCE DATA

The charts reproduced as Figs. 2 and 3 show distinct peak cycles due to unloading. To avoid establishing high peaks it is customary in most places to have a regular attendant in the substation, who notifies the foremen to reduce loads when necessary.

The daily and monthly data from the G. C. elevator, as well as from others of this type, show wide fluctuations in all factors. For instance, with elevator G. C. the load factor or hours' use of maximum demand per month ran from 95 hours to 184 hours during 1914 and from 44 hours to 260 hours during 1915. It should be recalled that the 1915 crop was very heavy, much of it not reaching the elevators until the spring of 1916. During the fall of 1915, to care for the rush, the elevator managers in Port Arthur were granted the right to increase temporarily their maximum demand without permanently increasing the minimum.

Unfortunately, it has been impossible to secure data on the total number of bushels elevated. This figure, with the number of bushels cleaned, should serve as a basis for more consistent operating results, owing to the fact that each time grain is moved inside the elevator, either for cleaning or to change from one storage bin to another, it must be elevated, with a corresponding increase in kilowatt-hours consumed. It is hoped



FIGS. 2 AND 3—CHARACTERISTIC LOADS OF TWO TERMINAL GRAIN ELEVATORS, SHOWING DISTINCT PEAKS DUE TO UNLOADING

that this important item of internal grain handling will receive greater attention on the part of elevator managers interested in power costs.

The ratios of maximum demand to installed capacity (item 8) agree fairly well for the various elevators represented excepting D. S., which had a ratio of 33.2 per cent during 1915. Owing to elevator P. A. operating partly by steam, its demand factor is higher than for the elevators that are fully equipped with electricity. The ratios of average monthly peak to the annual peak (item 10) show fair agreement for the same years, but will always depend upon grain crops and movements. Items 12, 13 and 14 indicate months of heavy and light grain movements and the lake navigation periods. All except the G. C. elevator have about the same average hours' use per month of the monthly maximum demand (item 18). Evidently the G. C. elevator is not yet operating at maximum handling capacity, a condition which is still further emphasized by item 4. Of the various load factors probably item 19 will prove most reliable, although item 21 would prove most useful for rate-making purposes.

The number of bushels handled per kilowatt-hour of energy consumption (item 24) is probably the most useful figure to the power salesman, and for a strictly terminal elevator operating near capacity it appears fairly consistent. The effect of the load factor on the price

paid per kilowatt-hour is reflected in item 27, since elevators G. C., P. A. and D. S. operate on the same rate. The energy-cost figures are interesting, but it should be noted that the Port Arthur rates were reduced on Sept. 1, 1915, approximately 7½ per cent.

While the data given are reliable, the Port Arthur figures being obtained from monthly records and compiled by the author, great care should be exercised in using the figures without duly considering local conditions. In comparing these figures with coal costs it should be remembered that data referring to steam operation are seldom if ever obtainable in the same detail that electrical data are. Attention is also called to the fact that the power costs given herewith are complete with the exception of fixed charges, maintenance on the substation equipment and the expense of necessary attendance. As a rule a man is kept in the substation during the time the elevator is in operation, but in many cases automatic arrangements could be made to care for peak loads, and an occasional visit by the electrician in charge of the elevator would be sufficient. Whether electric power be generated or purchased, an electrician is necessary to care for the equipment about the elevator.

Elevator superintendents who have not had experience with purchased power usually appear strongly to favor steam operation with slow-speed engines directly connected to a heavy line shaft. They argue that since an elevator must have some steam for drying grain and must burn some dust or waste, it is cheaper to make power on the premises by steam than it is to purchase electricity. However, dryer plants are not operated continuously and are of relatively small size, requiring little space and few refinements. To operate a steam engine or turbine which would meet the total power requirements of a grain elevator is probably more costly per kilowatt-hour or per average monthly-peak horsepower than is generally recognized owing to the usual low load factor. That purchased power at the rates obtainable in Port Arthur and Fort William is satisfactory is indicated by the additional elevators now under construction and using purchased power.

TABLE II—OPERATING DATA FOR SIX GRAIN ELEVATORS

Item	Formula for Calculating Data	Capacity of Elevator									
		G. C. 3,250,000 Bu.			P. A. 9,250,000 Bu.		D. S. 1,750,000 Bu.		W. T. 2,000,000 Bu.	Con. 1,750,000 Bu.	G. T. 5,750,000 Bu.
		1914	1915	1916	1915	1916	1915	1916	1916	1916	1916
1. Total bushels grain handled—receipts plus shipments	.....	23,101,399	38,504,923	52,028,758	.....	94,913,953	.....	26,637,578	54,069,158	38,691,171	50,105,627
2. Working hours, elevator in operation	.....	3,265	3,618	3,509	.....	3,735	.....	7,076	5,785	3,301	.....
3. Average hours operated per day (300 days	(2)÷300	10.9	12.0	11.7	.....	12.44	.....	23.6	19.25	11.0	.....
4. Bushels handled per bushel total storage capacity	(1)÷Total storage	7.11	11.85	16.0	.....	10.25	.....	15.22	27.0	22.1	8.7
5. Bushels handled per hour operated, average	(1)÷(2)	7,070	10,650	14,850	.....	25,400	.....	3,760	9,350	11,720	.....
6. Total rated hp. of motors installed	.....	2,345	2,345	2,345	905	905	542.5	602.5	1,415.5	1,037	2,468
7. Hp. maximum demand, sustained 10-minute peak	.....	956	1,159.5	1,125	424	460.75	180	321.75	777	697	1,397
8. Ratio of maximum demand to installed capacity (per cent)	(7)÷(6)	40.7	49.4	48	46.9	51.7	33.2	53.3	54.9	67.2	56.5
9. Hp., average of monthly maximum demands	.....	763.3	733.0	1,006	272	392	132.6	246	643	595	.....
10. Ratio of average monthly peak to yearly peak (per cent)	(9)÷(7)	79.8	63.3	89.3	61.4	85.1	73.6	76.6	82.7	85.3	.....
11. Ratio of average monthly peak to installed capacity (per cent)	(9)÷(6)	32.5	31.2	42.8	30.1	43.3	24.4	40.8	45.4	57.4	.....
12. Date of yearly maximum demand	.....	May and Nov.	Dec.	May	May	May	Dec.	Dec.	Nov.	May and Dec.	.....
13. Date of heaviest monthly kw.-hr. consumption	.....	June	Oct.	July	Oct.	Aug.	Nov.	Nov.	Nov.	.....	.....
14. Date of least monthly kw-hr. consumption	.....	Aug.	Aug.	Feb.	Jan., July, Aug.	Feb.	Feb.	Mar.	Mar.	.....	.....
15. Total yearly kw.-hr. consumption	.....	970,300	901,443	1,231,834	676,274	781,040	279,580	453,190	1,251,367	.....	.....
16. Average hp. load during hours operated	(15)÷[(2)×0.746]	398	334	471	.....	280.5	.....	85.6	290	.....	.....
17. Average kw.-hr. per month	(15)÷12	80,800	75,100	102,600	56,400	65,100	23,300	37,700	104,300	.....	.....
18. Average hours' use per month of monthly maximum demand	.....	140.4	120.2	133.7	212	221	209.5	198.5	207	.....	.....
19. Load factor, based on hours operated and average of monthly peaks (per cent)	(15)÷[(2)×(9)×0.746]	52.1	45.5	46.7	.....	71.5	.....	34.8	46.6	.....	.....
20. Load factor, based on hours operated and maximum demand for year (per cent)	(15)÷[(2)×(7)×0.746]	41.6	28.8	41.7	.....	60.9	.....	26.65	38.6	.....	.....
21. Load factor, based on total time and average of monthly peaks (per cent)	(15)÷[8760×(9)×0.746]	19.4	18.73	18.7	38	50.4	32.2	28.2	29.7	.....	.....
22. Load factor, based on total time and maximum demand for year (per cent)	(15)÷[8760×(7)×0.746]	15.5	11.9	16.7	24.4	25.9	23.7	21.6	24.6	.....	.....
23. Ratio of average load to average rate of handling (per cent)	(16)÷(5)	5.62	3.14	3.17	.....	.....	.....	2.275	3.1	.....	.....
24. Bushels handled per kw.-hr. (average)	(1)÷(15)	23. 8	42. 7	42. 3	.....	.....	.....	58.8	43.2	.....	.....
25. Total power cost (power bills)	.....	$19,816.47	$17,959.29	$20,971.92	$7,197.99	$8,634.02	$3,089.96	$5,272 99	$11,863.13	$10,857.00	$24,168.21
26. Power cost per hour operated	(25)÷(2)	$6.07	$4.97	$5.97	.....	$2.31	.....	$0.745	$2.05	$3.29	.....
27. Power cost per kw.-hr., in cents (average)	(25)÷(15)	2.045	1.99	1.702	1.064	1.106	1.104	1.165	0.948	.....	.....
28. Power cost per thousand bushels grain (cents)	(25)÷[(1)÷1000]	85.7	46.6	40.2	.....	.....	.....	19.8	21.9	28.05	48.2
29. Power cost per hp.-year, based on yearly peak	(25)÷(7)	$20.72	$15.50	$18.63	$16.95	$18.73	$17.16	$16.40	$15.26	$15.57	$17.28
30. Power cost per hp.-year, based on average of monthly peaks	(25)÷(9)	$26.0	$24.50	$20.83	$26.42	$22.90	$23.30	$21.45	$18.45	$18.23	.....

Labor Economy of Industrial Trucks and Tractors

Factors Influencing the Purchase of a Fleet of Forty-nine Storage-Battery Vehicles in an Automobile Plant—Data on Labor-Saving and Cost of Operation

IN THE modern growing automobile factory systems for transporting material are as varied and various as probably could be found employed by any single industrial concern. The cause for this is obvious. The automobile industry in its mushroom growth has cried out for increased production; increasing production has meant speedier movement of raw materials to machines and more rapid movement of parts from machines to assembly. To get this rapid movement factory men have employed hand trucks, gasoline automobiles of all kinds, industrial locomotives, motor-driven conveyor systems, electric industrial trucks and electric industrial tractors. Of all these the two last-named conveyances are newest to the business, but they effectively fill a field which is distinctively their own in the general scheme of material transportation.

Factors That Influence Selection of Trucks

To cite definite experience with these electric storage-battery-driven trucks and tractors, the results at the plant of the Willys-Overland Company at Toledo may be taken as an example. That company bought its first two industrial trucks about five years ago. From time to time it has added to that nucleus of its fleet until it now has forty 1-ton (0.907-t.), 1.5-ton (1.36-t.) and 2-ton (1.814-t.) trucks. Within the last year this fleet was further augmented by the addition of nine storage-battery tractors. The first trucks were bought because one of the Overland company's officials, seeing similar trucks at work in a freight station, grasped the idea that by using them in the factory he could reduce labor costs, which were then beginning to increase alarmingly. In fact, when the first two units were bought it was figured that they would save their own cost in three years, even if the price of labor remained at the level where it then was. When the first two units arrived they immediately proved that with the same force of labor immensely large quantities of material could be handled.

That the performance of these trucks was satisfactory in every respect is evident from the growth of the fleet. In each instance wherein trucks were purchased it was necessary, however, to take into consideration many factors entering into the haulage problem. The first of these was the length of the haul. For any distance above 150 ft. (45.72 m.) it was found economical to employ a tractor to move trailers, but for hauls slightly longer than this, and especially for mixed loads going to several destinations, industrial trucks were found to be more economical. Hand trucks are employed on shorter hauls. In the Overland plant, which covers about 110 acres (44.52 hectares) of floor space and an actual ground area of 105 acres (42.49 hectares), hauls as long as 150 ft. (45.72 m.) are the rule, not the exception. Grades are also a factor, since for hand trucks extra laborers for pushing are required. Trucks and tractors at the Overland plant both successfully pull loads up 12 per cent grades 135 ft. (41.15 m.) long.

The second consideration is the relative weight and bulk of the material to be handled. The heavier the material in relation to its bulk the more suitable it is for electric trucking. A third consideration is the width of factory aisles, for the electric trucks and tractors can traverse narrower aisles than most other conveyances. Aisle widths are, of course, governed by real-estate values and, in these days of poor delivery,

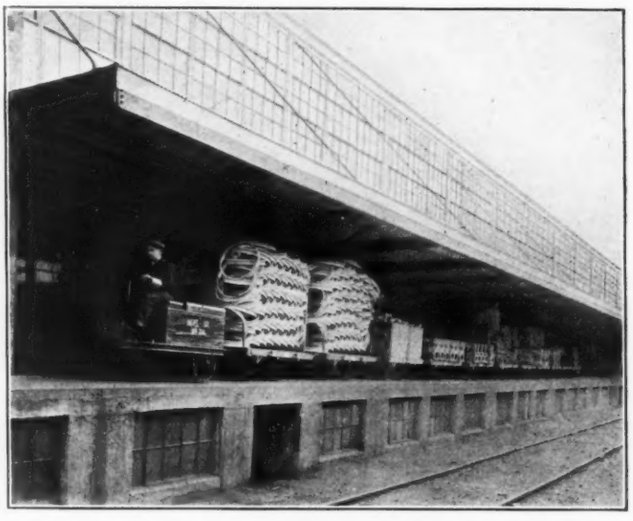


FIG. 1—THIS TRACTOR HAULING ELEVEN TRAILERS IS PULLING A LOAD OF 16,195 LB.

The load is made up as follows: Two trailers with surmountable rims weighing 1695 lb.; one trailer with automobile hubs weighing 3135 lb.; two trailers with automobile cylinders weighing 1870 lb.; two trailers with automobile springs weighing 2165 lb.; two trailers with automobile top bows weighing respectively 450 lb. and 420 lb.; two trailers empty weighing 385 lb. each.

by the necessity for storing material in every available inch of floor space.

In the fourth place, the amount of material of any one kind to be moved at one time from one fixed point to another must be considered. If there is a constant stream of material moving between two fixed points, a conveyor system may be more economical than trucks. But as a general rule the movement must be exceptionally heavy to justify the conveyor, and certainty that flexibility is not needed must exist to exclude the industrial trucks. The fifth consideration is the capacity of existing lifts and elevators, for unless these vertical movers will carry at least a 3-ton (2.7-t.) load the economical operation of trucks will be impaired owing to the impossibility of carrying full loads.

The conditions influencing selection of tractors are in general the same as those which govern selection of industrial trucks, with a few exceptions. A tractor costs about 33 1/3 per cent more than a 2-ton (1.814-t.) truck, but will pull loads from four to five times as great. It is exceptionally well adapted to handling incoming freight shipments to storage, while the work

of the trucks is confined more to interdepartmental transportation.

The problem of properly manning, charging and maintaining this fleet of vehicles is an important one. Each truck carries a crew of two men—a driver, who helps load and unload, and a helper. The trucks sometimes haul one trailer if handling light, bulky material, and in such instances an additional helper is required. The tractors haul any number up to ten trailers. A driver and a helper go with each train and the majority of actual work of loading is done by special crews stationed at proper points.

CARE AND MAINTENANCE OF THE FLEET

The entire truck and tractor fleet is housed and charged in an 80-ft. by 80-ft. (24.38-m. by 24.38-m.) garage, in which there are twelve 40-amp. mercury-arc rectifiers and fourteen 40-50-amp. motor-generator sets. Sets of small rating were chosen for this work on account of the gradual growth of the fleet. But even if the garage were to be re-equipped the small units would probably have preference because of the greater flexibility they give for charging one or two trucks at all hours of the day and night. The present practice in adding to this equipment, however, is toward the use of the motor-generator sets rather than rectifiers, on account of the high expense for tube renewal and the lower general maintenance cost of motor-generator sets when the equipment must be handled largely by unskilled labor. Moreover, the motor-generators permit of charging at high rates for short periods, which is necessary occasionally with the alkaline batteries used. The fact that these batteries are equipped with different numbers of cells, ranging from twenty-one to forty-two cells each, is another reason for the preference accorded small units, since each battery can be efficiently

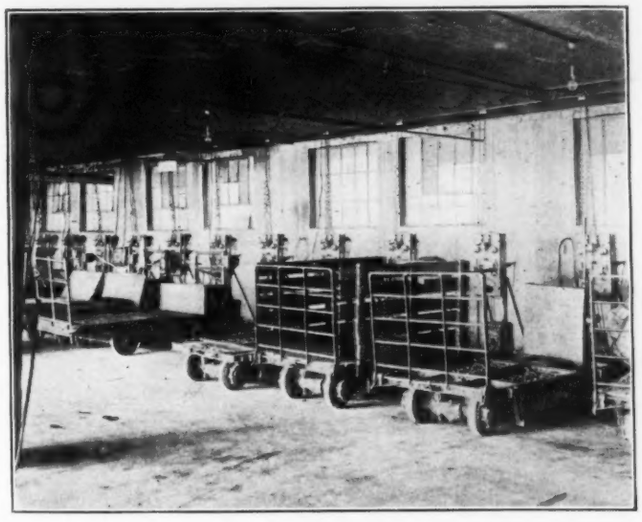


FIG. 2—THE TRUCKS ARE PLACED ON CHARGE IN THIS GARAGE BY THE DRIVERS

given just the charge it needs. A maintenance crew of two men is employed in the garage, but the trucks are ordinarily put on charge by the drivers.

OPERATING AND COST DATA

While no accurate over-all data are available on the total labor saving effected by the fleet, there are sufficient individual instances to be convincing. For example, where eighteen men were formerly needed to unload small 6-volt storage batteries from freight cars eight men and one industrial truck now do the same work and do it faster. Three men who formerly helped push hand-truck loads uphill through a long tunnel were released for other work, since tractors and trucks pull most of the loads. It is said by the foreman, H. Byers,

FIG. 3—THE TRUCK CARRYING BATTERIES HAS A LOAD OF 3080 LB.

Following it is another loaded with transmission and differentials weighing 3654 lb.

who is directly in charge of electric trucking, that, on the average, tractors under the Overland company's conditions have reduced the labor required by one-half and have at the same time speeded the handling of ma-

TABLE I—OPERATING RECORD OF A 2-TON TRUCK TAKEN OVER THIRTY-ONE DAYS

Date, March 8 to April 12, Inclusive	Hours in Service	Mileage, Loaded	Mileage, Empty	Tonnage	Ton-Miles	Average Tonnage per Hour	Average Weight per Load in Lb.	Maximum Load in Lb.	No. of Men in Gang	Wages of Men	Kw.-Hr. Charge	Cost of Power at 1.6 c. per Kw.-Hr.	Cost of Labor per Ton	Cost of Power per Ton	Maintenance per Ton	Invest. Depree. per Ton
Thurs.	11	4.8	...	19	5.0	1.7	2110	3000	2	7.50	14	0.22	0.39	.011	...	...
Fri.	11	4.6	...	19	4.1	1.7	1800	3000	2	7.50	8	0.12	0.39	.006	...	...
Sat.	10	4.2	...	19¼	4.2	1.9	2020	3000	2	6.60	18	0.28	0.34	.014	...	...
Mon.	8	2.0	...	9¼	1.5	1.1	1540	2800	2	4.80	11	0.17	0.52	.018	...	...
Tues.	10½	3.8	...	11	3.1	1.0	1690	2000	2	7.05	3	0.04	0.64	.004	...	...
Wed.	10½	4.2	...	23	4.2	2.2	2000	2000	2	7.05	12	0.19	0.30	.008	...	...
Thurs.	10½	4.5	...	22	3.8	2.1	1700	2000	2	7.05	13	0.21	0.32	.009	...	...
Fri.	11	4.2	...	14½	3.5	1.3	1700	2000	2	7.50	14	0.22	0.51	.015	...	...
Sat.	11	3.5	...	16½	3.1	1.5	1830	2000	2	7.50	15	0.24	0.45	.014	...	...
Mon.	8	3.5	...	12	2.9	1.5	1710	2000	2	4.80	12	0.19	0.40	.015	...	...
Tues.	10½	4.2	...	13	3.5	1.2	1730	3000	2	7.05	15	0.24	0.54	.018	...	...
Wed.	11	4.8	...	7½	3.6	0.6	1500	3000	2	7.50	15	0.24	1.00	.032	...	...
Thurs.	10½	4.5	...	19	4.0	1.8	1800	2000	2	7.05	16	0.25	0.38	.013	...	...
Fri.	10½	4.8	...	13¾	4.8	1.3	2000	2500	2	7.05	28	0.44	0.51	.032	...	...
Sat.	11	4.6	...	16¼	4.6	1.4	2000	3000	2	7.50	7	0.11	0.46	.006	...	...
Mon.	8	3.8	...	11	3.2	1.3	1800	2000	2	4.80	21	0.33	0.43	.030	...	...
Tues.	11	4.3	...	14½	3.8	1.3	1800	2000	2	7.50	16	0.25	0.45	.017	...	...
Wed.	8	3.4	...	11¼	2.8	1.4	1700	2000	2	4.80	18	0.28	0.42	.025	...	...
Thurs.	10½	4.1	...	15	4.1	1.4	2000	2000	2	7.05	17	0.27	0.47	.018	...	...
Fri.	10½	4.1	...	13½	3.7	1.2	1800	2000	2	7.05	11	0.17	0.51	.012	...	...
Sat.	8	3.3	...	12	2.9	1.5	1800	2000	2	4.80	16	0.25	0.40	.020	...	...
Mon.	11	4.9	...	13½	4.1	1.2	1700	2000	2	7.50	9	0.14	0.55	.010	...	...
Tues.	8	3.2	...	12¼	2.8	1.5	1800	2000	2	4.80	14	0.22	0.40	.017	...	...
Wed.	11	4.2	...	15	3.9	1.3	1900	3000	2	7.50	15	0.24	0.50	.016	...	...
Thurs.	11	4.3	...	18¼	4.0	1.6	1900	2000	2	7.50	14	0.22	0.41	.012	...	...
Fri.	11	2.0	...	10	1.6	0.9	1660	2000	2	7.50	13	0.21	0.75	.020	...	...
Sat.	8	3.8	...	17½	3.9	2.1	2150	2000	2	4.80	15	0.24	0.27	.013	...	...
Mon.	11	1.8	...	7¼	1.6	0.6	1800	2000	2	7.50	20	0.32	1.03	.044	...	...
Tues.	11	2.8	...	12½	2.1	1.1	1560	2000	2	7.50	20	0.32	0.60	.025	...	...
Wed.	11	3.4	...	12¼	2.5	1.1	1530	2000	2	7.50	15	0.24	0.61	.019	...	...
Thurs.	11	1.3	...	7¼	1.0	0.6	1600	2000	2	7.50	13	0.21	1.03	.029	...	...
Total, 31 days	315	116.7	...	438	103.9	...	...	...	...	208.7	448	...	...	...	...	...
Aver., 1 day.	10.0	3.7	3.7	14.1	3.3	1.4	...	...	...	6.73	14	0.22	0.51	.015	.036	.058

Average cost per ton-mile, cents: Labor, 2.04; power, 0.066; maintenance, 0.010; investment and depreciation 0.017=$2.097.

terial. The trucks have reduced hand labor 40 per cent and also show an increase in handling speed. Perhaps the best evidence that the fleet is a factor in speeding production is the fact that the electrical department receives immediate and vigorous complaints from departmental production foremen whenever a single truck or tractor is in the garage for necessary repairs. The reason for this can be readily appreciated when it is stated that the fleet—forty trucks and nine tractors—handles in an average day more than 2,000,000 lb. (907,180 kg.) of material, each unit traveling an average distance of 11.6 miles (18.669 km.). Detailed data on a typical day's hauling are given in Table II.

TABLE II—A ONE-DAY'S HAULAGE RECORD FOR THE FLEET

Truck No.	Lb. per Day per Truck or Tractor	Miles per Day per Truck or Tractor, Loaded and Empty	Hours per Day in Service	Character of Material Handled
Tractors:				
21	145,248	16	10	Sheet steel
22	145,248	16	10	Sheet steel
48	105,000	17	11	Sheet steel
47	105,000	17	11	Sheet steel
24	98,000	16	10	Miscellaneous
25	98,000	16	10	Miscellaneous
26	150,000	14	10	Miscellaneous
27	150,000	14	10	Miscellaneous
31	30,000	15	11¾	Cushions
Trucks:				
1	15,000	12	12	Miscellaneous
46	16,000	6	9	Tires
3	13,000	9	8	Miscellaneous
20	20,000	12	10	Miscellaneous
	15,000	11	9	Batteries
4	23,000	10	9	Generators and motors
45	36,000	9	9	Miscellaneous
16	42,000	12	10	Miscellaneous
41	33,000	7	11	Axle springs
2	26,000	12	11	Miscellaneous
37	10,000	14	11	Motors and transmission
32	45,000	13	11	Motors and transmission
35	43,000	13	11	Sheet steel
29	43,000	16	10	Miscellaneous
8	26,000	9	9	Miscellaneous
30	26,000	12	11	Miscellaneous
28	33,000	11	10	Running boards
43	33,000	11	10	Running boards
44	33,000	11	10	Miscellaneous
36	33,000	11	10	Miscellaneous
6	33,000	11	10	Miscellaneous
9	32,000	8	10	Cushion springs
10	10,000	8	10	Rims
7	42,000	6	11	Transmission
11	32,000	7	11	Torsion tubes
12	10,000	10	11	Miscellaneous
14	23,500	8	11	Miscellaneous
15	29,000	11	11	Batteries
17	18,000	7	11	Miscellaneous
18	22,000	12	10	Miscellaneous
19	17,000	12	10	Miscellaneous
34	14,000	14	11	Miscellaneous
33	42,000	9	11	Miscellaneous
23	20,000	12	11	Miscellaneous
39	16,000	12	11	Miscellaneous
42	16,000	12	11	Miscellaneous
13	16,000	12	11	Miscellaneous
5	16,000	12	11	Miscellaneous
40	14,000	8	9	Miscellaneous
Extra	25,000	12	11	Miscellaneous
Total	2,007,490			

Data on the total cost of operating one of the 2-ton trucks for a month are given in Table I. From these data it will be seen that the total cost, including wages, electrical energy, maintenance, interest and depreciation, is $2.097 per ton mile ($1.431 per t.-km.). The truck to which these data apply was in service an average of ten hours a day. Its average daily mileage loaded was 3.7 (5.955 km.); its mileage empty was also 3.7. Its average daily total tonnage was 14.1 (12.7 t.), and its daily work was 3.3 ton-miles (4.82 t.-km.). Its average tonnage per hour was 1.4 (1.27 t.).

Labor is by far the largest item of cost. The energy for charging was purchased under the Overland company's general wholesale contract with the Toledo Railways & Light Company. Interest was figured at 6 per cent and depreciation at 12.5 per cent. The operating costs on tractors would be somewhat lower than these figures, it is believed, because of the greater tonnage they handle. These data are believed to give a more accurate idea of actual hauling costs than over-all data could give because the trucks are used at times for such other work about the factory as pulling cable into underground ducts, etc. The trucks and charging equipment were installed and are maintained under the direction of W. A. Hill, electrical engineer for the plant.

INSULATING BARRIERS FOR USE WITH TRANSFORMERS

These Barriers Are Formed of Totally Inclosed Impervious Casings Containing Oil in the Form of Films or Layers

Insulating barriers for transformers or the like where extra high tensions are present are the basis of an invention by Willis A. Ishler of Pittsfield, Mass., in patent No. 1,223,881. The insulating barriers are formed of totally inclosed impervious casings containing oil in the form of films or layers, preferably in the form of oil-soaked fibrous sheets. At one or both sides of the oil layer may be applied one or more thicknesses of other insulating materials as conditions may require. A structure of this kind may be made in the form of a fairly flexible pad which may be wrapped around the part to be insulated.

MERCURY-ARC RECTIFIERS

Three-Phase Current Converted Into Star-Connected Multiphase—Rectifying from Each Phase

In three-phase or even six-phase mercury-vapor rectifiers operating at a given voltage the output is limited by the electrical strain imposed upon the electrodes, as above a certain current strength the electrode temperature will become too high and impair the proper working of the rectifier. The output increases with the number of phases. Therefore the invention of Ernst Oelschlager (patent No. 1,218,952), assignor to the Siemens-Schuckertwerke of Berlin, Germany, is directed first to turning delta-connected three-phase current into star-connected multiphase, and secondly, to rectifying from each of the many phases so produced. The continuous-current mains to be supplied from the rectifier are connected on the one hand with the mercury of the rectifier and on the other hand with the zero point of the star-connected phase windings of the phase transformer. Each part or phase is connected at one end with the common zero point and at its other end with one of the electrodes of the rectifier. The number of these electrodes must, of course, be the same as that of the number of parts or phases of the winding. In connecting the several phases with the electrodes the same order of succession must be observed, so that a rotating field traversing the windings will cause the maximum voltage between the cathode and the series of anodes to travel circularly around the anodes.

Lighting in Automobile Factories

Relative Costs of Lighting Equipment and Factory Buildings, Losses Arising from Poor Lighting, and Examples of Good Lighting in Representative Plants

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SUMMARY.—The author touches briefly upon the magnitude of the automobile industry and points out the relation of investment required for lighting equipment to the total cost of modern factory buildings and also to the cost of such parts of the equipment as elevators, cranes and the ventilating system. The importance of lighting in improving production efficiency is emphasized and estimates are made of the loss occasioned by poor lighting. Special attention is called to some excellent examples of artificial lighting in representative plants.

GOOD illumination is one of the most important influences that contribute to efficient production in manufacturing plants. Without it the best laid plans of continuous-line work, etc., will not produce the desired results. Workmen will be delayed in groping for tools and materials or in adjusting their machines. The accuracy of the work performed under such conditions may also suffer seriously. Furthermore, as was pointed out in one of the preceding sections of this series, accidents will be increased by the absence of adequate light. These facts are particularly noticeable in the automobile industry, where men are required to concentrate on specialized work to keep up with the demand for pleasure cars and commercial trucks.

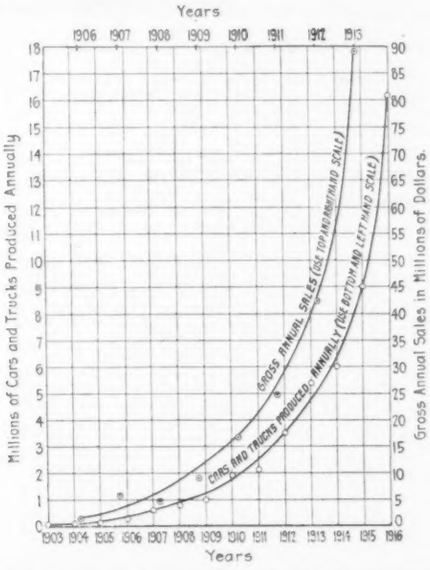

Years
1906 1907 1908 1909 1910 1911 1912 1913
Millions of Cars and Trucks Produced Annually
Gross Annual Sales in Millions of Dollars.
GROSS ANNUAL SALES (SEE TOP AND RIGHT HAND SCALE)
CARS AND TRUCKS PRODUCED ANNUALLY (SEE BOTTOM AND LEFT HAND SCALE)
1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916
Years

FIG. 1—GROSS ANNUAL SALES OF FORD COMPANY AND ANNUAL PRODUCTION OF ALL MAKES OF CARS

The increase in the manufacture of automobiles during recent years constitutes one of the most stupendous developments in the history of industry. According to the United States census, the value of the manufactured product in 1909 was $250,000,000 in round numbers, and the output was roughly 1,000,000 cars and trucks. In 1916 the output of cars and trucks of all makes was placed by reports at more than 16,000,000, the value of which may be estimated conservatively at close to $5,000,000,000. The last figure represents roughly a 2000 per cent increase over the corresponding figure for 1909. The gross annual sales during eight years of the Ford company's experience are shown graphically in Fig. 1, which also indicates the number of cars and trucks of all makes produced annually between the years 1903 and 1916 inclusive.[1]

RELATIONS OF COST OF LIGHTING EQUIPMENT TO COST OF PLANT

To illustrate the approximate cost of lighting equipment in its relation to the cost of the buildings used by modern automobile plants, and also to show how the cost of lamps and wiring compares with the initial costs of such parts of the plant equipment as elevators, cranes and the ventilating system, data based on the new shops of the Ford plant are cited. The total cost of these additions is given as $1,127,117.30, of which $1,039,793.89 represents the cost of the buildings only. The cost per square foot of floor is about $1.64 ($17.60 per sq. m.). A modern system of factory lighting, under normal price conditions, depending somewhat on the type of lamps and the methods of wiring, costs about $50 to $150 per 1000 sq. ft. ($537 to $1,610 per 1000 sq. m.) of floor area, or 5 to 15 cents per square foot ($0.54 to $1.61 per sq. m.). These figures are based on actual costs in old plants where the wiring was installed

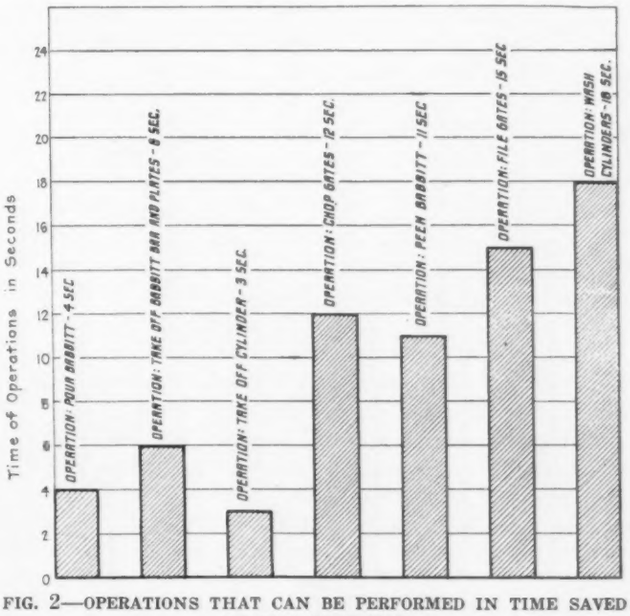
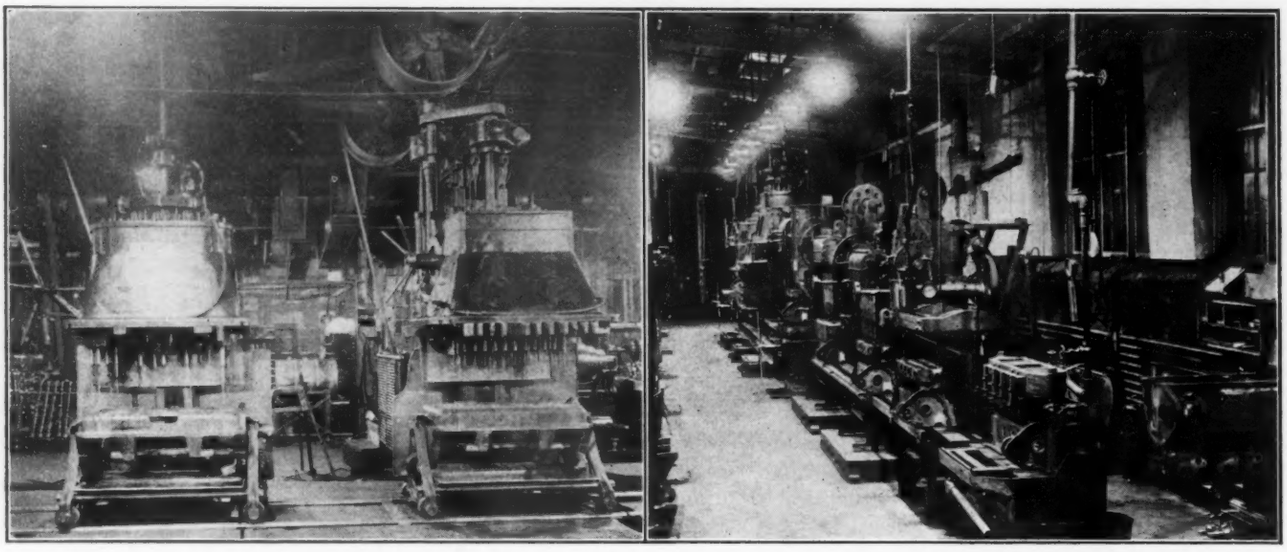

Time of Operations in Seconds
OPERATION: POUR BABBITT - 4 SEC.
OPERATION: TAKE OFF BABBITT BAR AND PLATES - 6 SEC.
OPERATION: TAKE OFF CYLINDER - 3 SEC.
OPERATION: CHOP GATES - 12 SEC.
OPERATION: PEEN BABBITT - 11 SEC.
OPERATION: FILE GATES - 15 SEC.
OPERATION: WASH CYLINDERS - 18 SEC.

FIG. 2—OPERATIONS THAT CAN BE PERFORMED IN TIME SAVED BY GOOD LIGHTING

[1]Fig. 2 and the curve on the left in Fig. 1 have been plotted from data found in Arnold and Faurote's "Ford Methods and the Ford Shops," published by the Engineering Magazine Company, New York, and several references are made to this book in a portion of the text. The curve on the right in Fig. 1 is based on data in an article by D. M. Lay in the *Automobile* for March 15, 1917, page 549.

in an old structure. Taking the minimum value of 5 cents per square foot ($0.54 per sq. m.), because the installation was made in a new plant at the time of construction, it follows that the modern plant of the type referred to will require an initial investment for lighting equipment equal to about 3 per cent of the entire construction and equipment cost.



FIGS. 3 AND 4—NIGHT VIEWS IN MACHINE SHOPS OF HUDSON AND KISSEL AUTOMOBILE COMPANIES

In the Hudson shop 200 alternating-current mercury-vapor lamps are mounted 11 ft. above the floor, 20 ft. apart, making the power demand for lighting 0.97 watt per square foot of floor area. In the Kissel shop 100-watt gas-filled tungsten-filament lamps equipped with krinkled-glass reflectors are placed 10 ft. to 12 ft. apart at 12 ft. above the floor, making a demand of 0.7 watt to 1 watt per square foot of floor area that is illuminated.

It is interesting to compare the initial costs of elevators, cranes and the ventilation system with that for lighting. In the Ford additions the cost of elevators is given at $23,500, that of cranes at $11,950, and that of the ventilation system at $51,873.41, these figures amounting roughly to 2, 1 and 5 per cent of the total initial cost of the plant respectively. The cost of lamps and wiring will therefore roughly approximate the cost of the ventilating system. It is hardly necessary to point to the wisdom of including the lamps and wiring as a part of the initial outlay for such buildings, since it is believed that the value of sufficient artificial lighting is now becoming generally recognized by the managements of modern automobile plants.

Too much emphasis cannot be placed on the saving in minutes and seconds obtainable in connection with the many detailed operations of automobile manufacture. Having the production processes and assembly carried out in their logical order by men and at machines arranged in the corresponding order relative to each other has produced remarkable results. However, if the necessary light is not furnished, each man cannot perform his work in the minimum time nor with the best results, and the advantages theoretically obtainable with continuous-line work will be offset.

Some idea of the value of a second saved or lost by some influencing factor like lighting can be obtained from a study of the following data[2] and of Fig. 2. Machining of a cylinder, which requires forty-five minutes, costs roughly 1 cent a minute (based on $5 a day of eight hours). Upkeep of cutting tools and overhead expenses also amount to about 1 cent a minute each, making the total gross charge of manufacturing one cylinder, involving twenty-eight operations, $1.35. The actual assembly of a piston and rod, which takes one minute and twenty-four seconds including inspection, involves (1) driving out the pin, (2) dipping it in oil, (3) slipping it into the rod eye, (4) turning the pin to take the screw, (5) inserting set screw, (6) tightening the screw with a wrench, inserting cotter pin and spreading ends. Fig. 2 shows graphically the time required for each of seven operations out of eighty-four required in motor assembly. The entire assembly of a motor takes 226 minutes.

The annual or continuous charge for light will be very small in terms of wages. In marked contrast, the losses due to poor light will be correspondingly exaggerated. Thus if twenty men work in an area of 1000 sq. ft. of floor area (92.7 sq. m.) a good system of lighting for this space and number of men will cost about $80 per annum with certain assumptions as to energy cost, interest and depreciation on the investment, etc., while the gross labor charges, including upkeep and overhead, per annum may be as much as $80,000 for such a unit area. In other words, the cost of light would equal roughly one-tenth of 1 per cent of the wages, and in like manner a loss of one minute per day for every workman due to bad lighting conditions would result in a gross loss of about $180 per annum for the twenty men, or more than twice the total annual charges for light.

ESSENTIAL QUALITIES IN THE LIGHTING SYSTEM

From the foregoing data it can be seen that careful attention to lighting is as essential to production efficiency as the adoption of time-saving methods. There can be little or no question concerning the wisdom of installing the lamps overhead and of doing away as far as possible with the inconvenience and annoyance of drop lamps close to the work. A representative case of good lighting is illustrated in Fig. 3, which shows a section of the machine shop of the Hudson Motor Car-

[2]These data are based on the present practice of the Ford company, where continuous-line assembly, use of work-carrying chutes and the plan of holding the motor as nearly at one level as possible during the entire course of assembly are employed.

Company, Detroit, illuminated by mercury-vapor lamps. Attention is called particularly to the large amount of light, all from overhead lamps, which reaches the drills at the point of greatest importance to the operator. It is of interest to note that the lamps in this shop are spaced on 20-ft. (6.1-m.) centers and are mounted 11 ft. (3.4 m.) above the floor, so that about 0.97 watt is

FIG. 5—NIGHT VIEW OF GARAGE ILLUMINATED BY TUNGSTEN LAMPS WITH REFLECTORS

required per square foot of floor space (10.3 watts per sq. m.). About 200 lamps of the mercury-vapor type are installed in this shop.

A night view in the assembly department of the Maxwell Motor Car Company, Detroit, is given in Fig. 6, which shows the good effects of the illuminaton system employed. In this building, which is more than 700 ft. (213.4 m.) long, the bodies of the cars are built up on trucks which may be moved along rails extending throughout the entire length of the building. The various parts are added as the car travels along, until at the end of the building the car is run off under its own power. It is interesting to note that in this shop one car is completely assembled practically every minute. The lamps in this section are of the mercury-vapor type spaced approximately on 20-ft. by 26-ft. (6.1-m. by 7.9-m.) centers, and the watts per square foot amount to approximately 0.75 (8.07 watts per sq. m.).

To indicate the results obtainable with gas-filled tungsten-filament lamps under approximately similar conditions, Figs. 4 and 7 are shown, representing machine-tool work and assembly respectively. In each case 100-watt units are used with X-ray No. 570 direct-lighting reflectors. The spacing of the lamps is from 10 ft. to 12 ft. (3 m. to 3.7 m.), and the mounting height is 12 ft. (3.7 m.) above the floor. From 0.7 watt to 1 watt per sq. ft. (7.53-10.75 watts per sq. m.) is required.[2] About 3 ft.-candles to 5 ft.-candles is used for garages in general.

METALLIC CONDUIT MOLDING

Provided with Beveled Corners at Base and Locking Ribs at Edges of Side Walls

A conduit system adapted for wall or ceiling work is proposed by William A. Bonnell of Brooklyn, N. Y., in patent No. 1,217,398. The conduit body consists of a base plate and side walls. At the junction with the base plate the side walls are beveled to meet the base plate, thus forming latching shoulders to be engaged by the ribs formed on the side walls of the box-like cover. Retaining fingers which are sheared out of the side walls of the body may be bent by hand or by a tool around the conductors after they are laid in place. In this case the retaining fingers are not cut back completely to the base plate, but only to the beveled portions of the body, so that when the cover is in place the side walls and ribs completely close up these openings. In this form the members may be assembled either by slipping the ribs over the outer edges of the side walls of the body member, or the ends of the body and cover may be engaged and the latter slid longitudinally over the former after the conductors are in place.

FIGS. 6 AND 7—NIGHT VIEWS OF ASSEMBLING DEPARTMENTS IN MAXWELL AND KISSEL AUTOMOBILE PLANTS

About 280 mercury-vapor lamps are used in the Maxwell shop, being mounted 20 ft. to 26 ft. apart at 14 ft. above the floor, making the demand 0.75 watt per square foot. In the Kissel shop 100-watt gas-filled tungsten-filament lamps equipped with krinkled-glass reflectors are mounted 12 ft. above the floor and 10 ft. to 12 ft. apart. The demand is 0.7 to 1 watt per square foot.

[2]Figs. 3 and 6 are shown through the courtesy of W. A. D. Evans of the Cooper Hewitt Electric Company, to whom are also due the data relating to these installations. Figs. 4 and 7 have been taken specially for this article in the works of the Kissel Motor Car Company, through the courtesy of J. L. Stair of the National X-Ray Reflector Company, who has furnished the data covering the installations shown.

Discussion of Insulator and Cable Problems

Eleven Papers Were Presented at Special Meeting of A. I. E. E. in New York—Cables, Insulators, Mining, Water Power and Heating of Apparatus Were Subjects Considered

MOST of the papers presented at the special meeting of the A. I. E. E. held in New York June 27 and 28 dealt with subjects connected with high-tension cables and insulators. Four of the eleven papers presented were on mining, water power and heating of apparatus.

Particular emphasis was laid in the insulator papers on the fact that mechanical causes are principally responsible for insulator failures, cracking, absorption and unequal expansion being given as frequent sources of trouble. Dielectric flux concentration as a cause of insulator failure and the need of standardization in joint construction were also brought out. Among the remedies suggested were to use elastic cement, minimize the amount of nesting, avoid flux concentration, and use materials that have similar coefficients of expansion.

The importance of keeping dielectric losses low was alluded to in all of the cable papers, it being pointed out that these have a considerable influence on cable rating. Dampening the ground surrounding cables or operating them under practically submarine conditions was again brought up as a means of increasing cable ratings so that existing installations as well as new ones can be used to better advantage.

One of the mining papers took up the considerations which affect the selection of apparatus and types of distribution systems for bituminous coal mines, while the other gave the performance of one of the largest mine hoists in the world, showing that the over-all efficiency was 46.7 per cent under working conditions. A paper on economical combinations of steam and hydroelectric plants contained a very interesting method of determining the annual costs of water-power and steam plants used separately or in combination.

Abstracts of nine of the papers follow.

OPERATION AND MAINTENANCE OF UNDERGROUND CABLES

Problems That Are Involved and Some of the Solutions for These Problems, Including Method of Increasing Radiation

Since the cost of underground cables for power distribution has doubled in the last two years, it is especially urgent at this time for operating engineers to devise methods whereby the ratings of existing installations may be increased considerably above the values they were supposed to give. Assuming that cables are made of good material with good workmanship and design, John L. Harper pointed out that the fundamental causes of cable failure are joint trouble, mechanical injury of lead sheaths, and overheating, the latter being the most important.

The incorporation of a joint-filling compound that has not the same characteristics as the insulating compound used in the cable may also cause trouble as a mixture of the two may have very different insulating characteristics from either of the original compounds. If cables are cut and allowed to hang down and bleed slightly, a bubble of air is liable to get into the cable. Later when the cable is in operation and thoroughly heated the bubble may expand, displace the insulating compound and eventually cause failure.

Overheating.—The retention of constantly produced heat, no matter how small, will build up temperatures which will not only impair the insulating characteristics of the cable but will destroy the cable itself. The problem, therefore, is one of controlling the dielectric loss and producing an even and rapid dissipation of all heat produced within the cable. The obstruction to rapid dissipation of heat from the cable or conduit may not be in the cable itself or in the conduit structure, but may depend on the quality and condition of the earth surrounding the conduit.

To decrease the first cost of the underground distribution of power the dissipation of the heat should be increased at least to the point where the power value of the I^2R losses may be made to balance the operating expense of increased construction and installation. This can be done by dampening* the earth surrounding cable ducts, by circulating water through porous tile, or by flooding the cable ducts and operating them under practically submarine conditions where possible.

INSULATION CHARACTERISTICS OF HIGH-VOLTAGE CABLES

Dielectric Losses and Chemical Instability of Insulation Constitute Important Factors in Rating of Cables

Practically all failures of high-voltage underground cables, W. S. Clark and G. B. Shanklin pointed out in their paper, are due to heating, usually not over their entire length, but at certain points known as "hot spots." Since the dielectric losses rise rapidly with temperature and have a cumulative tendency at high temperatures, they constitute an important factor in the rating of cables. Paper-insulated cable, which is the most generally used of all types of cable, is susceptible to the widest variation in its insulation characteristics.

The first tests referred to by the authors in their paper were for the 60-cycle dielectric energy loss in a standard type of mineral hydrocarbon-base cable compound. Tables and curves were given showing the variation of relative permittivity, power factor and specific gravity with temperature. The relative permittivity was found to decrease with increase of temperature, corresponding values of specific gravity varying in the same way.

The next set of tests were on single-conductor paper-insulated cables, data being obtained showing the vari-

*Suggested by L. E. Imlay in a paper before the A. I. E. E. in 1915.

ations of watts loss, per cent power factor, relative permittivity and specific resistivity with temperature. The authors bring out the fact that never yet have they found a case where cable trouble can be attributed to initial moisture. Sometimes the moisture may become entrapped in cable joints, but it never travels along the cable to any great extent. Rubber-insulated cable protected by lead sheathing undergoes a chemical change due to heating. Therefore chemical instability under temperature and voltage stress is a predominating factor in cable insulation trouble. Remarkable similarity is shown between watts and permittivity cycles with rubber, varnished cambric and other insulation. It is to be expected that the material with the highest effective alternating-current resistance at high temperature would be the least liable to deterioration at "hot spots" and is therefore the most desirable one to use.

From tests of three-conductor paper cable it was concluded that the highest possible surface resistance should be afforded especially at high temperatures. Stresses between the inner tangential points of the conductor, occurring where cable temperature is highest, will probably be the limitation to maximum voltage ratings of cables in the future. In one cable which had given trouble in operation the weak spot was found to be at a point heated above the average duct temperature by external sources, indicating that the dielectric energy loss must have been so high that it was comparable with the copper loss. With a power factor as high as the one tested (54 per cent) at 100 deg. C. it is safe to say that trouble will occur at "hot spots" in time.

Paper insulation has the poorest temperature characteristics, compared with varnished cambric and rubber-insulated cables, and must be of the highest grade to bring the 100-deg. C. resistivity well up in value. Varnished cambric excels paper in desirable quality. Although its resistivity characteristics are not particularly good, it is very stable and uniform and has good mechanical qualities. Rubber has the best temperature characteristics, but the physical changes that take place in it prohibit its use at high temperatures.

After a continuous run of a year or more at twice normal voltage, some coils were examined and found to have deposits on the walls of the gas spaces, although very little damage was done. Over-stressing cables to a point where internal ionization begins is to be avoided in practice.

CABLE JOINTS AND THEIR METHOD OF CONSTRUCTION

Necessity of Engineers Agreeing on Requirements to Permit Standardization—Costs and Time of Construction Now Vary

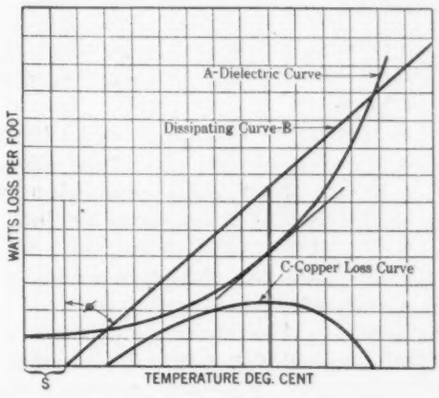
Owing to the fact that the number of companies installing cables for operation at 20,000 to 25,000 volts has increased in the last few years, D. W. Roper points out that it is essential that engineers come to some agreement on the fundamental requirements of joints so that their construction may be standardized. Some idea of the need of standardization may be obtained when it is considered that the labor cost for joints made under similar conditions varies from $5 to $30 and the time required for making them ranges from less than half a day to a day and a half, depending on the methods and construction employed.

Mr. Roper suggested a number of tentative specifications the adoption of which, he says, would be a step toward standardization. These will be presented in a later issue of the ELECTRICAL WORLD.

DIELECTRIC LOSSES AND CABLE RATINGS

Method of Calculating Rating of Cable from Dielectric Loss and Heat-Dissipation Curves—Effect of Soil Temperature

From a number of tests made by A. F. Bang and H. C. Louis to obtain information regarding the maximum permissible rating of cables it was found that a mineral oil base gives much better results than a rosin-oil base



GRAPHICAL METHOD OF DETERMINING CABLE RATING BASED ON DIELECTRIC LOSS AND RATE OF HEAT DISSIPATION

as an impregnating compound. The tests were made on four different specimens of cables from three different manufacturers, all of them being three-conductor No. 4/0 paper-insulated copper cable. The curves in the accompanying diagram show how the cable rating may be determined.

As it was evident that very unstable and dangerous conditions exist in high-tension duct lines when the critical temperature is reached, the authors developed a method for determining the critical temperature for any duct line and also the temperatures that will be reached under given loads. The method is as follows:

Determine the dielectric loss curve of this cable and represent as A in the cut. The heat-dissipating curve for the duct line and cable can be drawn as B. The soil temperature at a distance sufficiently far from the duct to be unaffected by the heat dissipated in the duct will determine the abscissa of the lower end of curve B.

If it is now assumed that constant conditions have been reached where no heat is used for increasing the temperature of the cable and duct, the watts which can be dissipated as indicated by B will equal the total losses generated (dielectric loss plus copper loss). Therefore the allowable copper loss can be determined graphically by subtracting A from B, giving C. From this curve the corresponding current can be calculated by the formula $I = \sqrt{W \div 3R}$, where W represents the watts taken from curve C, and R is the resistance of one conductor at a temperature taken from the corresponding point of curve B. A change in soil temperature will cause a parallel shifting of the heat-dissipation curve, producing an entirely different copper-loss curve.

DESIGN AND MANUFACTURE OF PORCELAIN INSULATORS

Cracking and Absorption Causes of Insulator Deterioration—Reduction of Nesting and Elasticity in Joints Recommended

The two most important elements producing insulator depreciation, A. O. Austin pointed out in his paper, are cracking and absorption. Insulators which crack usually fail suddenly. Hence it is impossible to anticipate their failure by any practical electrical tests. The largest and apparently the strongest insulators crack soonest, the size, shape and number of the cemented joints appearing to be the influencing factors. Old insulators when heated up slowly will often crack before they attain 150 deg. Fahr. (65.6 deg. C.). When their tops are sprayed with water after being heated up, as in a thunderstorm, a very much larger percentage of cracking occurs. In the first instance the parts which fail are the tops or shells outside of the large cement spaces, while in the second the failure is usually confined to the head of the insulator.

So long as insulators are subjected to the weather, the percentage of failures seems to be the same whether they are in service or not. The usual absence of any electrical indications of weakness goes to show that the cracking is due to the high mechanical stress rather than to electrical fatigue. The stress due to a slight expansion of the cement, though not serious in itself, might combine with other causes to produce failure.

Much effort has been expended to incorporate the following characteristics in modern pin-type insulators: (1) A few strong parts; (2) small heads with corresponding cement sections and areas; (3) minimum amount of nesting permissible with mechanical reliability, and (4) elasticity in the joint. Insulator joints, to be satisfactory, should have a minimum area for a given grip, should not slip and should have an elastic yield or ability to distribute a heavy load. Coated sanded surfaces fulfill all of these requirements to a marked degree. The author gave sketches and discussed various types of joints.

In order to insure the mechanical reliability of an insulator it is advisable that the cap should bear on the flange to prevent the escape of cement while setting. The present practice is to sand all grip surfaces and to use a moderate assembly temperature, so that dangerous shearing stresses will not be set up in cold weather. The use of elastic sanded surfaces very much reduces the danger of cracking. The best practice, however, for very heavy loads is to use insulators which transmit all their stress to a wood or fiber core. Still greater refinements are obtainable at minimum cost through the use of coated sanded surfaces, and it is probable that improvements in the near future will be along this line.

To obtain insulators which will not fail by absorption it is necessary that the body composition be vitrified to the extent that the pores are entirely sealed. In the firing or burning process the important factors are to have (1) a means of determining the firing history of each individual piece; (2) a body composition that is satisfactorily vitrified over as wide a temperature range as possible, and (3) a close control of the firing of the ware. Thermometers and pyrometric cones are used to check the temperatures and for indicating the finishing temperatures. Disks or rings whose shrinkage can be accurately measured are employed to determine the shrinkage which the insulators undergo in firing. With the present thickness of insulator materials voltage tests just below the flash-over value are hardly severe enough to be satisfactory. However, if the regulation of the circuit is poor and the voltage is raised so that a violent flash-over is produced, a very effective test is obtained, as a maximum stress is exerted on all zones.

INSULATOR TROUBLES AND SOME REMEDIES

Mechanical Stresses and Dielectric Flux Concentration Given as Sources of Trouble—Some Improvements Suggested

According to W. D. Peaslee, the porcelain insulators on the market to-day deteriorate too rapidly both in and out of service from certain inherent causes. Part of the difficulties may be overcome by correct mechanical design and by the proper distribution of the dielectric flux.

Not being satisfied with the generally accepted theory explaining the failures of insulators, Mr. Peaslee began an extended research in 1914, which included a microscopical analysis of insulators using polarized light and crossed Nicols prisms. From this investigation it was observed that some action takes place inside the cap of suspension units and between the shells of a pin-type unit which causes deterioration when the units are not in service. Some insulators in service deteriorate at a very rapid rate owing to dielectric stresses combining with other stresses.

The results of the investigation show four important contributing causes of failure: (1) Mechanical stresses due to temperature changes necessarily resulting from the different coefficients of cubical expansion of the materials; mechanical stresses due to the change of volume on account of different moisture contents, and mechanical stresses due to improper firing and cooling of the porcelain; (2) dielectric flux concentrations due to improper design of insulator shapes and defects in the porcelain; (3) dielectric flux concentrations due to the fact that the porcelain is inevitably made of two or more materials of widely different physical properties, one isotropic and the others anisotropic in character, and (4) mechanical stresses due to the difference in coefficients of expansion of the constituents of the porcelain acting to establish a separate surface between the crystals.

An examination was made of the cement in 218 insulators, the histories of which were well known. Of those failing electrically (207) all but fifteen contained cement whose absorption after two hours' baking at 120 deg. C. and four hours' boiling in water was over 12 per cent. In some failing quickly the absorption ran up to 45 per cent. Of those which had failed mechanically or were still good (eleven) one had cement whose absorption ran over 6 per cent. Microscopic examinations of a great many samples have shown that flow lines exist which are mechanically weak and have a great tendency to develop minute cracks, apparently during cooling.

To avoid the troubles mentioned the author lays down the following requirements for insulators: (1) A cement must be developed that will be elastic enough to with-

stand expansion and contraction under different temperatures. (Some compounds have been tried, but so far as the writer knows they are not a commercial success.) (2) Improve the design of the insulator to avoid flux concentrations, make it unnecessary to place dielectrics of different permittivities in series, and improve the workmanship to avoid defects. (3) Make the insulator from an amorphous, non-crystalline substance containing only one constituent, or only those of the same electrical and temperature characteristics.

Fused quartz gives promise of some success as an insulator material. Its temperature coefficient of expansion is about one-fifth that of porcelain, its dielectric strength is very high, its mechanical strength and elasticity are good, and it withstands indefinitely the action of high-frequency voltages. It has certain drawbacks, but these for the most part have been overcome. The problem now is to produce this material commercially so that the cost will not be prohibitive.

CALCULATING TEMPERATURE OF ELECTRICAL APPARATUS

Method Pursued in Determining—Rate of Cooling Said to Be a Function of the Watts per Pound of Copper

Three general methods of determining the temperature of electrical apparatus at shutdown were explained in a paper by V. M. Montsinger. The methods are: (1) to plot a cooling curve and extrapolate back to the instant of shutdown; (2) to use an arbitrary correction, and (3) to calculate the rate of cooling. A very simple formula is derived for carrying out the last method.

$$\theta = 1.95\, W_c^{0.7}\,(1 - \varepsilon^{-0.106\, W_c^{0.3} t}),$$

where θ = cooling in deg. C.

W_c = watts per pound of bare copper.

$$\text{at 75 deg. C.} = 2.577\, C^2 \left(1 + \frac{e}{100}\right) 10^{-6},$$

e = eddy current loss in per cent of I^2R,

t = time in minutes after shutdown.

This formula is based on the observation that cooling of oil-immersed transformer windings for a limited time (four or five minutes) after shutdown is approximately a function of a watt per pound of copper.

EXPANSION A CAUSE OF INSULATOR DETERIORATION

Absorption of Moisture by Cement and Overfiring of Porcelain Given as Frequent Causes of Insulator Trouble

Expansion was given in the paper by J. A. Brundige as the principal cause for the continued and seriously high rate of depreciation experienced with high-voltage insulators of the cap and stud type. This stand was based on the fact that the temperature expansion coefficient of porcelain is only one-half that of steel, and that the volume of cement will change considerably under the influence of varying moisture conditions. Excessive loads also accelerate deterioration, although several instances point to the contrary.

From megger and oscillator tests made during the last three years on transmission systems in widely separate parts of the country and embracing over 600,000 suspension insulators the following observations were made: Although the end units of insulator strings are theoretically subjected to greater electrical stresses than the intermediate units, they do not appear to fail at a faster rate than the others. Tests on stored insulators showed that they depreciate as fast as those in service. According to oscillator tests of 877 insulators which had been subjected to the entire range of commercial firing, the overfired units showed a tendency to fail more than any of the others, including the underfired units. Owing to the rapid depreciation of some insulators it was concluded that their failure was due to cracking rather than porosity. Some old types of pin insulators were found to be exceedingly porous compared with modern suspension-type units. When insulators are very porous they may be readily "weeded out" by high-voltage tests, but this method is not of much service in detecting cracked units. Furthermore, high-voltage tests may break down insulators that would otherwise be suitable for service for some time.

ECONOMICAL COMBINATION OF WATER AND STEAM PLANTS

Price Conditions Favorable for Water-Power Development if Legislation Does Not Hinder—Determining Economical Combinations

In a paper by H. S. Putnam there is given a very simple method employing empirical formulas or curves for determining the most economical combination of water power and steam plants.

From the results obtained several conclusions were made. Where a market for the power is available or can be created, practically all water power should be developed beyond the minimum power available, and hence all water-power plants require steam plants in connection with them. Water-power plants are most valuable when developed in connection with steam plants. The point of economical development of the water power is increased as the operating cost of the plant is increased and as the value of money decreases. Therefore, under the present conditions of high fuel and labor expense and the downward tendency of money value, it is a particularly opportune time to develop water power. The policy under which additional burdens are imposed on water-power development, whether by the government or other authority, is against the true interests of the public, and contrary to the best utilization and preservation of our natural resources. If a plan could be devised so that the government funds at low interest rates could be used for such developments, they would be greatly facilitated and the natural values created would react to the great advantage of the government, Mr. Putnam declares.

To illustrate the use of the formulas several typical examples were solved. For instance, it was determined what size development of a water power would secure better results than a steam plant. Solutions were also given for the following problems: When is it better to construct a hydroelectric plant than to extend an existing steam station? What is the most economical water-power development under given conditions? What is the most economical combination development?

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

BONUS SYSTEM STIMULATES OHIO OPERATING MEN

Outline of Method Used by Ohio Company Based on Coal Consumption per Kilowatt-Hour Output

Every man employed by one Ohio electric-service company is being offered a bonus, the size of which depends upon the coal consumed per kilowatt-hour delivered to the switchboard. The system is as follows:

Coal Consumption per Kw.-Hr.	Bonus per Man	Coal Consumption per Kw.-Hr.	Bonus per Man
2.85 lb. to 2.95 lb.....	$1.00	2.65 lb. to 2.75 lb.....	$9.00
2.75 lb. to 2.85 lb.....	3.00	2.55 lb. to 2.65 lb.....	15.00

As the system has not been in force for a year, it is not known how the improvements which have been experienced have been affected by weather conditions, changes in personnel of the plant or increase in load. Results before and after the bonus system was adopted are given herewith:

COAL CONSUMED PER KILOWATT-HOUR

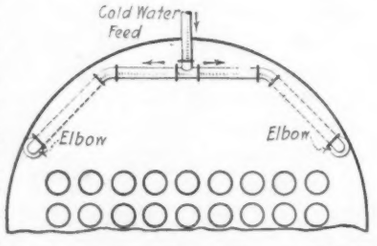
Before Adoption:	Lb.	After Adoption:	Lb.
June, 1916.....	3.10	October, 1916.....	2.87
July, 1916.....	3.38	November, 1916.....	2.76
August, 1916.....	3.11	December, 1916.....	2.88
September, 1916.....	2.98	January, 1917.....	2.84
		February, 1917.....	2.83

WATER HAMMER IN FEED PIPE

How Trouble with Cold-Water Feed Pipe in Fire-Tube Boiler Was Corrected

BY T. W. REYNOLDS

Having experienced serious water hammer in connection with the feed-water pipe supplying a fire-tube boiler, the piping was examined and peculiar conditions were observed where the water entered the boiler. As shown by the full lines in the accompanying drawing, the pipe branched inside the boiler at the T fitting and terminated at two 45 deg. elbows, allowing cold water to discharge directly into the steam space of the boiler. The difficulty was overcome by extending the pipes, as shown in dotted lines, from the 45 deg. elbows to points opposite the shell. After a lapse of time, however, it was found that the feed water impinging directly upon the shell at so close a range had corroded the metal at those points. As a remedy an elbow was fitted to the end of each pipe and turned so as to discharge the water along the length of the shell.

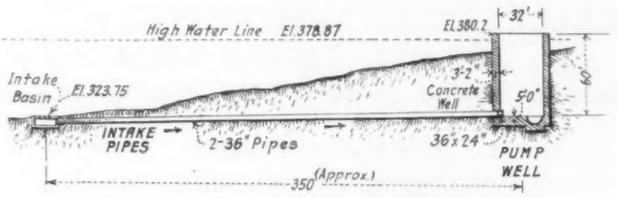


IMPROVED ARRANGEMENT OF BOILER FEED PIPE

SOLVING CONDENSING WATER SUPPLY PROBLEM

Pumping Station at River One Mile from Power House Built to Supply Condensing Water When Wells Prove Inadequate

Until recently the condensing water for the 9600-kw. power house of the Public Utilities Company of Evansville, Ind., was supplied from wells. As the supply from this source became inadequate it became necessary to determine whether to build a new power house at the river or bring water to the present power house from the river, 1 mile (1.6 km.) distant. The latter plan was adopted, a pumping station, a pump well, an intake in the river and two intake pipes from the intake to the pump well being installed. Construction of this system presented quite a problem, owing to the fact that the variation of the river level is nearly 50 ft. (15.2 m.). Further limitations were imposed because the Ohio River is a navigable stream and any construction work in it must conform to government rules.



LONGITUDINAL SECTION OF PUMP WELL, INTAKE AND INTAKE LINE

On account of the great rise and fall of the water it was necessary to construct the pump well 60 ft. (18.3 m.) deep. It is a hollow concrete cylinder with walls 3 ft. (0.9 m.) thick and was sunk by the open-caisson process, the entire structure settling as material was excavated beneath it by a clamshell bucket. The bottom of this caisson is floored with a heavy layer of concrete. The top of the pump well is slightly above the level of the ground and is designed to be above the highest water stage. The pumping station, which is circular, is constructed above it.

The intake pipes are laid on a horizontal level from the bottom of the well out into the river. They terminate in the intake proper, which is a large concrete box. The top of the box was placed approximately level with the bottom of the stream, since no obstruction to navigation was permitted by the government. Large circular openings were provided in this box to admit water, large floating drift being excluded by screens. Inside the pump well the two 36-in. (91.4-cm.) pipes, which lead from the intake through the wall of the pump well and connect with the pumps, are equipped with two 36-in. (91.4-cm.) Elliott strainers. Trenches for the intake and pipe line were constructed by the use of a cofferdam and by dredging when necessary. The river

cofferdam was continued into the bank for laying the pipe line.

The pumps are placed at the bottom of the pump well. Ultimately four centrifugal motor-driven 7000-gal.-per-minute Allis-Chalmers pumps will be installed, although only two are being placed at the present time. These pumps are driven by 150-hp., 2200-volt, three-phase, 60-cycle motors. Each pump is furnished with two sets of impellers, one for a high stage of water, when there will be a low head of water to pump against, and one for a low-water stage, when the resulting pumping head will be high. These pumps furnish sufficient head to force the water into 36-in. (91.4-cm.) cast-iron pipe leading to the station, through the condensers and into the waste pipe. The needs of the power house require only one pump at the present time, except on peak loads. Provisions have been made so that one of the pumps can be kept running while the impeller in the other is changed. A 6-in. (15.2-cm.) vertical motor-driven centrifugal sump pump is installed in the pump well to take care of leakage, overflow, seepage or other waste water that may enter the well.

All power for the pumping station is supplied from the power house over duplicate leads of underground cable to give maximum insurance against operating trouble. These circuits are controlled from the switchboard at the power house. In an emergency a telephone line connecting the power house with the pumping station may be used.

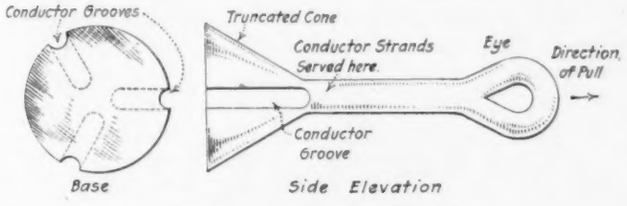
W. H. Koppelman, Louisville, Ky., was contractor for the well and pipe line; the Gould Construction Company, Nashville, Tenn., had the contract for the intakes and intake mains, and Joseph J. Gerringer was engineer for the Public Utilities Company.

CABLE-PULLING EYE

Design of Convenient Attachment for Pulling Conductors Where Long Runs Are Necessary

In pulling cable it is considered good practice among some cable men to make an attachment to the cable conductors as well as the sheath in all duct runs over 375 ft. (114.3 m.) in length. To facilitate such a connection, one of the foremen of the General Electric Company's cable-pulling crew, working on large cables at Cincinnati, developed an attachment eye shown herewith.

This device is made in two styles. One of them is a



DETAILS OF ATTACHMENT EYE

solid forging about 9 in. (22.8 cm.) long, having an eye at one end. The shank is made of 1-in. (2.54-cm.) round stock, one end being upset or spread out in the form of a truncated cone. In this cone are three grooves which extend from the base toward the shank of the device.

In using this device the sheath of the cable to be pulled is cut saw-tooth fashion for several inches back from the cable end. The lead is then turned back and the conductors are peeled. After this operation the conductors are laid in the grooves in the cone-shaped end of the pulling device, and the strands are served around the shank of the tool. The saw-toothed lead-sheath ends are then bent down closely around the conductors and solder is sweated into the joint, making a smooth wiped joint. With these joints properly made it has been possible to break ropes designed to stand a 7.5-ton (6.8-t.) load without parting the joint between the cable and the eye. The second style of attachment eye is like the first, except that a swivel is used in the shank.

PROLONGING THE LIFE OF HEAVILY TAXED CROSS-ARMS

Oak Cross-arms Carrying Heavy Loads in Good Condition After Fifteen Years' Service, as the Result of Treatment

The 18-ft. (5.5-m.) cross-arms carrying the heavy lead shown in the accompanying illustration have been in service in their present positions for fifteen years.

OAK ARMS AND CHESTNUT POLES WHICH HAVE WITHSTOOD FIFTEEN YEARS OF SERVICE

The long life is attributed to the fact that they were made of seasoned wood and that for the first three years they were in place they were painted annually with coal tar. This tar formed a protective scum over the arms, which is still in evidence. The circuits which these arms support consist of four No. 0 wires, eight No. 1 wires and fifteen No. 6 wires. The spans measure about 90 ft. (27.4 m.) in length, so that the average wire loading per span would be 625 lb. (283.5 kg.). The corner structure, which is built of oak arms and 40-ft. by 7-in. (12.2-m. by 17.8-cm.) chestnut poles set in concrete, is also fifteen years old. The two anchors attached thereto consist of wooden deadmen buried 8 ft. (2.4 m.) in solid earth under 7 ft. (2.1 m.) of cinder fill. The steep banks of the Ohio River just beyond the turn made it necessary to use "stiff-leg" braces instead of anchors to hold the line in the foreground.

These lines are on the joint system of the South Covington (Ky.) & Cincinnati Street Railway Company and the Union Light, Heat & Power Company, which are both subsidiaries of the Columbia Gas & Electric Company.

OUTDOOR LOCATIONS FOR ELECTRIC METERS

Meter Cabinets Installed at Rear of Buildings, on Poles, etc., to Prevent Theft of Energy and to Facilitate Reading and Testing

BY N. NESBITT TEAGUE

Unusual locations have been selected for meters by the Augusta-Aiken Railway & Electric Corporation in a number of cases where trouble has been experienced from persons tampering with meters and stealing energy and where indoor locations of meters are inconvenient for meter reading and testing. For instance, meters for some apartments, small office buildings and stores are mounted in sheet-steel or wood cabinets at the rear of the building served. This position makes the meters accessible for reading and testing and thereby saves time sometimes wasted in gaining admission to indoor meters. The service wires are brought to the box in conduit and are distributed in conduit after passing the meter. Arrangements are made in these cabinets for two to thirty-six meters and for disconnecting the customer's circuits readily.

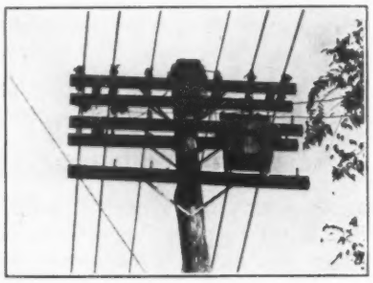


FIG. 1—INCLOSED METER MOUNTED ON POLE AND READ BY LINEMEN

In other cases where consumers such as industrial plants receive energy from individual outdoor substations the meters are inclosed in cabinets mounted on the substation structure. One installation of this kind is shown in Fig. 2. In this case the current transformers connected with the meters are mounted above the meter box. Use is made of the Detroit "Square D" switch and meter protective device. They have well warranted their cost and afford a neat-appearing installation. Where trouble has been experienced with consumers tampering with meters or attaching wires ahead of the meter the meters are sometimes mounted on a near-by pole and inclosed in strong steel boxes which are locked, not sealed. A small glass panel is provided in each cabinet to permit reading the meter. Linemen are employed to read these meters.

FIG. 2—METER CABINET ATTACHED TO SUBSTATION FRAMEWORK

On 13,000-volt installations the company also employs home-made steel cabinets instead of an expensive high-voltage manufactured outfit. The current and potential meter transformers are placed inside of the box with the meter. The meters are arranged so they may be read by the consumer and company without opening the door, and the box is kept locked save for occasions of periodic testing or authorized examinations.

CALCULATING RATINGS FOR ELEVATOR MOTORS

Factors That Determine Horsepower of Motor Used for Hoisting Service and Example of How to Use the Chart Given

Three factors determine the horsepower of the motor that should be used for elevator service, namely, the net weight to be hoisted, the speed of travel and the efficiency of the elevator. The chart shown herewith, which is for determining the horsepower required in any elevator installation, is based on average values of these factors. The efficiency of the elevator is assumed at 50 per cent. To determine the proper size of motor to use in any case follow the diagonal line corresponding to the unbalanced load up to the point where it crosses the vertical line corresponding to the speed desired. The value opposite the horizontal line through this point will indicate the horsepower of the motor required. If the efficiency is known to be other than 50 per cent, divide the horsepower obtained as explained above by twice the known efficiency in per cent.

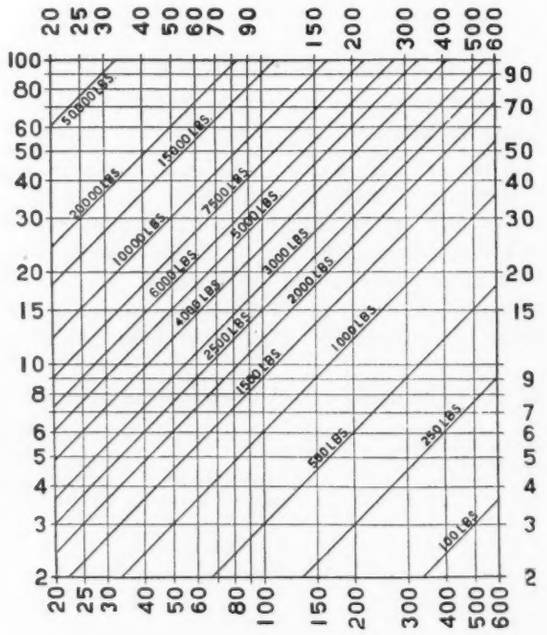


CHART FOR DETERMINING HORSEPOWER OF ELEVATOR MOTOR

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

TIME NECESSARY TO SELL NEW POLICIES TO PUBLIC

Many Complaints May Be Forestalled if Proper and Sufficient Explanations Are Made Before Changes Take Place

Before a new central station policy which may affect the public is adopted it is generally discussed pretty freely by the executive heads of the company, and they themselves become familiar with it, frequently it would seem without realizing that they are going to ask the public to become familiar with the policy, to like it, and to live up to it, within the short space of a few hours or days. In fact, on more than one occasion the time necessary to acquaint the public with the policy before making it effective has not been placed at the disposal of that department of the company which has as its duty explaining changes to the public, or what the advertising and public relations department of an Ohio company calls "selling a policy."

This department contends that before any change affecting the public shall be made sufficient time shall be given to advertise the change adequately—to acquaint the public with the new policy and the reasons back of it. The reason for the contention is the belief that the company can forestall many complaints about changes if it will take the time and go to the trouble to explain the necessity of changing before it actually issues the order which makes the change effective.

A 3-CENT RATE TO ENCOURAGE USE OF ELECTRIC APPLIANCES

Louisville Company's Salesmen Solicit Business for Dealers on Domestic Excess Consumption Rate Based on Number of Rooms

Since the Louisville Gas & Electric Company was organized through the merger of the five public utilities previously in the field its electrical sales attention has been concentrated on house wiring. Now that some 13,000 already-built homes have been wired, the company is changing its plan of attack and is just beginning a campaign which has for its sole object increasing individual consumption. It has just put into effect an arrangement by which its customers who are tolerably free users of energy may purchase all in excess of a stipulated amount at a net rate of 3 cents per kilowatt-hour. To encourage them to take advantage of this proposal a campaign has been mapped out in which the company's own salesmen will canvass the territory served, undertaking to sell electrical appliances for six of the leading dealers in the city. The lighting company itself handles no electrical appliances, not even lamps. Its house-wiring campaign ran through three years and a half on a plan by which the contracts signed by its own salesmen were divided among the electrical contractors of the city. All the company had at stake was the chance to sell its product to those with whom its salesmen made contracts. The same principle will apply in connection with the appliance sales campaign, which, while operative during June, does not go formally into effect until the first of July.

PLAN OF OPERATION

Instead of selling orders for installation of electric lighting systems in residences, each salesman for the lighting company will sell standard electrical appliances only to those who are now consumers of energy. All contracts will be turned over to one of the six local dealers who are participating with the company in the campaign. The rest of the transaction will be between this particular dealer and the purchaser of the appliance, terms of payment, etc., being standardized, however. Each of the six salesmen will operate on a flat salary, which will be supplemented by commissions paid on each appliance sale, the dealers in each case paying the commissions.

There are numerous points of interest to central station managers in connection with this campaign, whether the stations sell appliances or not. In the first place, the 3-cent rate proposition, which is not unique, is available on the excess consumption to all the domestic customers who will contract with the Louisville Gas & Electric Company for a monthly consumption of at least 3 kw.-hr. per room of their houses and will apply on all the energy used each month in excess of 6 kw.-hr. per month per room. The initial rate is 8 cents per kilowatt-hour inside and 9 cents outside city limits. This classification of the customers of the company at once lists some 10,000 domestic customers as logical "prospects" for the sale of appliances. They have been identified by the records on the company's books and by the reports of the meter readers.

ADVERTISING THE OPPORTUNITY

These customers were advised of the offer first through the newspapers. Then they were addressed through advertisements and also by means of information printed on the monthly statements which were sent out. Finally they were circularized, a few at a time. This plan will be continued as the campaign progresses, the 10,000-odd logical prospects getting the first attention. From week to week or day to day the salesmen will be provided with the names of those who have been addressed as well as with the names of those who have signed the contracts, and will follow these up with the personal calls. Each salesman will carry a book of photographs of the actual articles he is offering for sale. Everything in the way of an electrical appliance will be included—from sewing-machine motors up to motors of 5 hp., from percolators to enameling ovens, from washing machines to curling tongs, etc.—and the entire collection will represent the aggregate of the appliances handled by the dealers participating in the campaign.

The salesman gets tips to call at certain places from the office, as a result of inquiries made to the office, and in other ways. The company makes use on its bills of a form asking the customer to put a check mark opposite any of the listed proposals on which he may want further information. Bills are collected all through the month in all the salesmen's districts, and it often happens that they are kept busy responding to the inquiries so received. At all times they have lists of the non-wired houses on lines of the company and can at any time transfer their activities to a systematic canvass of their territory.

In the case of the appliance-selling campaign, the representative of the company obtains the signature of the customer to a contract. This is not with the gas and electric company, which expressly stipulates that

Let 3-Cent Electricity Solve Living Problems
SUN MON TUES
RI SAT
Make every week ELECTRICAL WEEK
A Wonderful, Value-Packed Electric Appliance Campaign Begins This Week.
See the Electric Appliances Demonstrated at Our Office.
WE have introduced electricity into 13,000 Louisville homes during the past 3½ years by applying progressive advertising and sales methods.
Now we propose to show our customers how to use 3-cent electricity to cut down labor and the high cost of living.
Simply telephone Main or City 2182, and we will send a representative to describe the cent electric rate and take your application.
LOUISVILLE GAS & ELECTRIC CO.
(Incorporated)

ONE OF THE OPENING ADVERTISEMENTS IN THE 3-CENT CAMPAIGN

it is not a party to the contract, but is between the purchaser and one of the six appliance dealers whose names are listed on the contract form. In case the purchaser has a preference for one or another dealer, the salesman so indicates, making out all contracts in triplicate, one of which goes to the customer, one to the dealer indicated, and one being held by the company for its files. If the purchaser has no preference, the contract is referred in blank to the commercial manager's office, where the assignment is made, attention being given to equalization of the distribution.

Three plans of payment are provided for—C. O. D., thirty days and a so-called club plan. The list price prevails on the first two, while there is an addition of 10 per cent of the purchase price to club plan purchasers, with certain exceptions. Club plan schedules call for payment of 20 per cent in cash, with the balance in six equal monthly payments or twenty-six equal weekly payments, a minimum monthly payment of $1 being provided for and a minimum of 25 cents for weekly payments, all to be direct to the dealer. The exceptions include fans, on which a 5 per cent addition to the list price is called for, one-third cash, with the balance in three equal monthly or twelve weekly payments; vacuum cleaners, on which a 10 per cent addition is called for, with a cash payment of $5 and the balance at the rate of $6.25 a month (where attachments are included the initial payment being raised to $6.25), and Eden washing machines, sold at a club plan price of $103, with a cash payment of $7.50 and the balance at the rate of $5 per month or $1.25 a week.

RATE OF SALESMEN'S COMPENSATION

Compensation for the salesmen is provided at a flat salary, which is $50 a month, with commissions of 10 per cent of the cash price on all appliances sold with the exception of the following: Electric fans, commission 5 per cent; motors, under 5 hp., commission 5 per cent; ironing machines, commission 5 per cent; additional wiring which is necessary to connect any motors, appliances or lighting units sold, commission 5 per cent; large electric ranges equipped with ovens, commission 7½ per cent. In addition to the commission allowed on the new lighting fixtures and the additional wiring, a bonus of $3 will be given the salesmen for each gas arc removed and replaced by an electric lighting unit. This bonus, however, does not apply unless the gas arc is taken down.

The month of June was devoted to preparation for the campaign. The newspaper advertising of the company was changed from housewiring to appliance-using, led by the general announcements of the appliance campaign. In addition, the company put on demonstration all of the items included in the list of appliances offered. This was in the big general offices of the company, to which many of the customers still come to pay their bills. The salary of one saleswoman is divided among the dealers and the company, each paying one-seventh. Whenever she can close with a customer she does so, making the same kind of a contract as the district salesmen do, although she does not obtain a commission as they do. When she cannot close she takes the name and address of the inquirer and turns it in to the office for the salesmen to take hold of.

DEMONSTRATING THE APPLIANCES

In addition to the advertising of the company and its demonstration, practically all of the dealers in the city are doing something extra along the same line. Demonstrations of all kinds of appliances are being given; the dealers themselves are doing more advertising, and the department stores and the other retailers handling electrical appliances in a small way are also finding their stocks of this character of merchandise more active than they ever have been before. It was the experience of the gas and electric company that the contractors doing that kind of work got more wiring contracts independently of and during the company's campaign than they ever had been able to get before. The small retailers and a stray electrical supply concern or two not in the campaign with the company are jubilant over the prospects. The effort is moving their own stocks for them and, generally, making electrical appliances the livest items of merchandise in town.

During June the salesmen of the gas and electric

company were careful students of salesmanship, giving particular attention to the lines they would shortly set out to sell. Nearly every day during the month they were called together and heard talks on salesmanship from experts in their lines. Special attention will be paid by the company to special classes of prospects. For instance, the country lines reach into a wide radius and offer an excellent field for sales of power equipment to the farmers, who could thus get the 3-cent rate for the power appliances used on their farms.

SUPERIORITY OF ELECTRIC POWER FOR METAL MINING

A Number of Points Which May Be of Value to Power Salesmen Enumerated at Meeting of Colorado Mining Men

At a recent meeting of the Colorado Metal Mining Association E. S. Siekmann of the Colorado Power Company read a paper entitled "The Application of Electric Power to the Metal Mining Industry," in which he enumerated the following points of superiority of electric service over other service for mining purposes, which may be of value to power salesmen in other communities:

POINTS OF SUPERIORITY OF ELECTRIC SERVICE

"1. Electric energy requires no hauling or handling to make it available for instant use. You can go up one side of the hill and down the other side with equal facility. An inexhaustible supply is ready when you need it.

"2. The electric motor is much easier to handle in the inaccessible places so often encountered, owing to the fact that it weighs only one-half as much per horsepower of capacity as other forms of prime movers. Statistics show that a motor in the usual size weighs about 107 lb. per horsepower as against 198 lb. in the case of an internal-combustion engine. This latter figure would be greatly increased in case of a steam engine, owing to the boilers and the other steam accessories.

"3. The matter of space, especially in places where timber or tunneling is extensive, is quite an item. Investigations show that the electric motor requires approximately only 40 per cent of the space that is required for other forms of power producers.

"4. First cost is a very important consideration and is often the feature of many mining properties, and a rough estimate of average mining conditions shows a difference in favor of electric power of about 25 per cent.

"5. The ability to get any desired speed variations is a most desirable asset of electric power.

"6. Speed of starting and stopping cannot be overlooked by the operator who is seeking to reduce expenses and liability of accidents to his men. The electric motor is the acme of simplicity in regard to this point. A small controller or starter is all that is required, and its operation is so simple that the most inexperienced man can, with a very little instruction, make the most powerful motor do its duty. It also enables an operator to control his power from a distance without regard to the location of the motor or of the other machinery employed in the mine."

COMBINED BLOCK AND ROOM RATE FOR SMALL TOWN

Maximum of 10 Cents per Kilowatt-Hour, with Minimum Number of Active Rooms Three, Minimum Charge $1

An electric service rate schedule combining the theory of block rates with those for active rooms and at the same time prescribing a minimum monthly charge has been placed in effect in Janesville, a Wisconsin town of less than 15,000 inhabitants, by the Janesville Electric Company.

The schedule adopted by this company is briefly as follows:

For all or part of the first 12 kw.-hr. consumed per month in premises having three active rooms or less, 10 cents per kilowatt-hour, plus 3 kw.-hr. for each room in addition to the first three. For all or part of the next 12 kw.-hr. consumed per month, 7 cents per kilowatt-hour in premises having three active rooms or less, plus 3 kw.-hr. for each room in addition to the first three. For all energy consumed in excess of 24 kw.-hr. per month, 3 cents per kilowatt-hour in premises having three active rooms or less, plus 6 kw.-hr. for each room in addition. The table herewith presents this schedule in convenient form.

DETERMINATION OF ACTIVE ROOMS

In determining the number of active rooms all rooms containing outlets shall be counted with the following exceptions: Three bedrooms, bathrooms, basement, unfinished attics, porches, closets, halls and hallways, except those used and furnished as living or reception rooms and having an area in excess of 120 sq. ft., which shall be classified as active. One active room with an area of more than 300 sq. ft. will count as two rooms. When two or more rooms exceed 300 sq. ft. each, only one extra room will be counted for each 300 sq. ft. of excess area.

TABULATION OF RESIDENCE RATE USED BY THE JANESVILLE (WIS.) ELECTRIC COMPANY

Cents per Kilowatt-Hour	Number of Rooms											Each Additional Room
	1-3	4	5	6	7	8	9	10	11	12	13	
10 for the first.....	12	15	18	21	24	27	30	33	36	39	42	Add 3
7 for the next.....	12	15	18	21	24	27	30	33	36	39	42	Add 3
3 for all over	24	30	36	42	48	54	60	66	72	78	84	Add 6

Where service for a barn, garage or outbuilding is supplied through the same meter as that through which service for the residence is supplied all active rooms in the barn, garage or outbuilding shall be added to those of the house and the rate applied to the total. When separate meters are supplied, a garage, barn or outbuilding shall be treated as a separate residence.

A minimum of $1 per month is charged and 50 cents per month additional for every horsepower (750 watts) or fraction thereof for each motor or appliance having a capacity of 1 hp. (750 watts) or more, subject to the prompt-payment discount. The minimum charge for rural customers requiring special extensions or transformer installations is computed in the same manner, but in no case shall the total charge be less than $2 per month.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

SURGE BREAKDOWNS IN ELECTRIC NETWORKS

Susceptibility of End-Turn Insulation to Damage, and How to Guard Against It—Value of Condensers for Protective Purposes

TWO important breakdowns on a network of the Société Lyonnaise des Forces Motrices du Rhone were referred to in an article in the *Revue Générale de l'Electricité* by M. J. Sarolea. The author attributes them to resonance set up by overvoltage surges. When considering methods of protection, he points out that it must be remembered that although cables and the various distributing apparatus may legitimately be expected to resist surge voltages occasioned by everyday conditions of manipulation and operation, it is going too far to expect (and is hardly possible to secure) immunity from damage under the abnormal conditions arising from dead short circuits, earths, incorrect connections, and so forth. Protection against such conditions must be provided by special apparatus, to the principles and design of which too little attention is paid, even in the most modern distribution systems.

Safeguarding the Insulation

In alternators it is necessary to pay close attention to the insulation turn to turn. The windings of alternators generally lack rigidity, and are subjected continually to vibration, to the powerful air currents set up by salient-pole rotors, and, worst of all, to violent and repeated electromechanical shock due to short circuits in the network and the rush of current caused by inaccurate synchronizing. The final effect is to wear away the cotton insulation and produce weak (or bare) spots, easily susceptible to breakdown turn to turn. The risk is particularly great inside tubes through which the coils pass. Owing to defective cooling facilities, and particularly when overloads are frequent, the cotton covering of the wires loses tenacity, dries to a carbonized appearance, and becomes friable. In new machines or in old ones undergoing repair every care should be taken to secure absolute rigidity in the coils, which, so far as possible, should be former-wound and impregnated with insulating compound. Another important advantage of the latter construction is that by excluding air from the coils the destructive effect of ionization is avoided. This effect is serious in non-impregnated coils where pressures of 8000 to 10,000 volts or over are concerned. Other precautionary measures consist in preventing over-voltages and steep-fronted waves from reaching alternators, which are always the worst insulated elements in distribution installations.

Inductances of very low value should not be inserted in the feeders and near the generating station, for they are liable to cause resonance of surge waves due to earths or short circuits. In order to carry to earth as soon as possible any dangerous over-voltages which may be engendered, voltage limiters should be installed at frequent intervals. The author recommends that these be connected directly to earth through small fuses. The limiters may be protected against even a momentary excess of current by providing them with permanent, solid resistances—say of some tens of ohms, according to the characteristics of the network. As a protection against high-frequency pressures, Gino Campos suggests that conductors be electroplated with high-resistance metal, so as to increase the skin resistance and damping. He installs also along the line coils with secondaries closed on ohmic resistances, inductances shunted on ohmic resistances, condensers in series with resistances, or a combination of these devices. Laboratory tests show surge attenuations of 65 to 99.5 per cent for frequencies from 50 to 500 kilocycles.

Attention is called to a recent patent in which Steinmetz proposes to avoid local resonance in the windings of large transformers by building these from coils containing a different number of turns and arranging the coils in various ways in series and parallel. The windings are not then homogeneous, and neighboring coils have different natural periods of oscillation; hence waves are limited by interference and damping, whether they are brought into the windings or originate within the latter. Feldman and Herzog state that hysteresis and eddy-current losses in the sheathing of armored cables are forty times as great as in the conductor itself for high-frequency oscillations. The damping is therefore relatively high, but the energy available may be six hundred times as great as in unarmored cables. Petersen damps out oscillations by rapid damping, and prevents resonance between the inductances of cut-out coils, measuring transformers, wattmeters or ammeters, etc., and the capacity of busbars and alternators, by shunting the inductances with small graphite resistances.

The author has faith in the possibilities of large-capacity condensers installed in the station on the busbars. The capacity must, however, be sufficiently large. Guilbert has recently stated that several hundred microfarads, installed at the alternator terminals, is required to prevent with certainty resonance of the fundamental harmonic. Such a capacity is inadmissible in practice; hence one is obliged to rest content with partial limitation of harmonic surges when using a protective capacity. The latter representing only a small fraction of the total capacity of the network, its connection to the busbars hardly modifies the resonance conditions for forced waves. The author concludes that in his particular network a capacity of 5 mfd. would protect windings against breakdown, turn to turn, caused by steep-front surges. Large capacities for industrial service would be costly and would occupy much space, but it is worth while to attack the problem of their use.

Specifications for alternators, it was urged, should in-

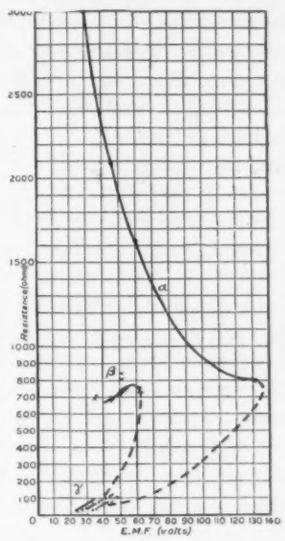
clude a clause requiring special insulation turn to turn and turn to frame on the leading-in sections of the winding (as in modern transformers). Pressure surges in generating stations, receiving stations or substations due to short circuits or "earths" on the line may, under present-day conditions, cause breakdowns which are very serious by reason of the interruption of service, as well as on account of the material damage caused directly. The study of such surges forms a special chapter in the technology of electrical distribution, and one which is yet scarcely opened.

Generation, Transmission and Distribution

Principles Involved in Computing Depreciation.—G. NICHOLSON.—In the opinion of the author, the policy of providing out of profits a sum sufficient to write off the plant during the term of its physical life is undoubtedly sound. So far as providing for improvements is concerned, however, the position is somewhat different, as shown below: (1) Such improvements will presumably result in increased efficiency and capacity, and therefore in increased profits. Why, then, should the profits of the earlier years be reduced by charging against the same improvements which will have the effect of increasing the profits of later years? That is certainly penalizing the shareholders of the early years and benefiting those of later years abnormally. In a new concern, of course, the original shareholders take the greatest risk, as they have no past results to guide them when contemplating investment. (2) Of course, if capital is charged with the same, it means that a higher revenue charge immediately commences to accrue so as to write down such increased capital; but as there is a larger revenue also accruing, this is not an additional burden. (3) The charging of improvements to revenue in the early years, having the effect of keeping down dividends, is bound to react when new capital is required, and it might be found very difficult to raise new capital even for necessary extensions (not improvements), which difficulty might seriously retard the development of what might otherwise have been a progressive concern. (4) Having regard to the prices obtainable for power and lighting supplies and to the cost of labor and materials, the author points out that there are many electrical undertakings in England operated by limited companies that are able out of profits (a) to provide for depreciation based on the physical life, (b) to provide for improvements based on the economic life of the plant, and (c) to pay a fair dividend to shareholders. (5) While it is of the utmost importance that every opportunity should be taken to strengthen the financial position of an undertaking, yet the management have a duty to perform to the shareholders, and therefore improvements of the nature indicated are more fairly treated as capital as and when they are incurred.—*Journal of the Inst. of Elec. Engrs.* (London), May, 1917.

Electrophysics and Magnetism

Electrical Properties of Molybdenite at High Temperatures.—A. T. WATERMAN.—Part of an article on the "Positive Ionization from Certain Hot Salts." Molybdenite has been found to possess a number of interesting electrical properties which include the following: In the range of temperature between that of the room and a brilliant red heat this mineral exists in two distinct states. The resistance in the low-voltage or low-temperature state is very nearly an inverse exponential function of the absolute temperature. At ordinary room temperatures the resistance is a function of the applied potential difference and appears to approach the value infinity as the potential approaches the value zero. The conduction of electricity is evidently carried on mainly by electrons. Two conclusions may be stated in regard to the thermionic emission from molybdenite: (1) A large emission from impurities—principally the ordinary K^+ emission; (2) a characteristic emission of Mo^+ ions, apparently having no exclusive relation to the break or to either state. The resistance of molybdenite after being subjected to an electric current at increasing voltages is shown.—*Philoso. Mag. and Journal of Science*, March, 1917.



ELECTRICAL RESISTANCE OF MOLYBDENITE

Structure of Atom.—Dr. SAUL DUSHMAN.—Second part of an article on this subject. In this section the author discusses several theories of the structure of the atom and shows how they agree or disagree with observed physical and chemical facts.—*General Electric Review*, May, 1917.

Electrochemistry and Batteries

Embrittling Action of Sodium Hydroxide on Soft Steel.—S. W. PARR.—From extensive investigations made by the writer, boilers using feed water containing sodium hydroxide often develop fine cracks radiating from rivet holes or extending from hole to hole. The experiments showed that the effect upon the metal is to cause brittleness which makes it less capable of withstanding steam pressure and temperature changes. Among the remedies suggested is the addition of a salt having properties which cause it to react with the alkali and yield a product which is entirely harmless. Magnesium sulphate ($MgSO_4 + 7H_2O$) is such a salt, the reaction being $2NaOH + MgSO_4 = Na_2SO_4 + Mg(OH)_2$. The resulting sodium sulphate remains in solution. The magnesium hydroxide, if the water is free from ammonia compounds, is insoluble and forms a precipitate or sludge. One pound of magnesium sulphate per 1000 gal. (0.12 kg. per 1000 l.) of water will react with an equivalent of 3 grains per gallon (0.05 grams per liter) of sodium carbonate. The water as used averages about 4.5 to 5 grains per gallon (0.077 to 0.085 grams per liter) of sodium carbonate, requiring a theoretical treatment of about 1.5 lb. of $MgSO_4$ per 1000 gal. (0.18 kg. per 1000 l.). By using 0.5 lb. to 2 lb. per 1000 gal. (0.059 kg. to 0.24 kg. per 1000 l.) it was found practicable to reduce the sodium hydroxide alkalinity to zero. When the treatment was discontinued the sodium hydroxide concentration would occasionally reach 75 grains per gallon (1.29 grams per liter) in the

boilers. A chemical which has been suggested in this connection is sodium dichromate. The reaction involved would be $Na_2Cr_2O_7 + 2NaOH = 2Na_2CrO_4 + H_2O$. It is possible that this salt may serve a dual purpose by taking up the nascent hydrogen which might otherwise go into the iron. Considerable hydrolization took place within the boiler, probably promoted by the presence of the organic matter, so that some chromium was precipitated in the form hydroxide $Cr_2(OH)_6$, and this material mixed with other solids had a tendency to fuse or bake as an incrustation along the highly heated surfaces of the flues. While the use of this material was of advantage in indicating the location of leakage conditions in the boiler, it was not continued long enough to prove it a neutralizer of the hydrogen that might be formed. Sulphuric acid has also been used. At first the amount of acid was 0.39 lb. per 1000 gal. (0.047 kg. per 1000 l.). It was soon increased to 0.54 lb. per 1000 gal. (0.065 kg. per 1000 l.). The entire amount of acid required for neutralization would be about 2.5 lb. per 1000 gal. (0.29 kg. per 1000 l.), which leaves an ample margin of safety between the free acid employed and the total alkalinity of the water. A quite uniform degree of sodium hydroxide alkalinity was the result. The sudden rise in the price of magnesium sulphate and sodium chromate was the chief argument in deciding upon the use of the free acid. It offers an advantage also in that it adds no further solids to the water, and from the viewpoint of the chemist it is more logical to add a free acid which will form magnesium sulphate within the boiler than to add the more expensive magnesium sulphate already prepared. It may not be wise, however, to recommend the use of the free acid except under conditions where absolute control and reliable supervision are assured.—*Bulletin No.* 94, University of Illinois.

Units, Measurements and Instruments

Concentric Standard Dynamometer Wattmeter.—A. E. Moore.—This paper discusses causes of defects in heavy-current dynamometer wattmeters, concentric main-current coils, progress in construction of experimental current coils and their defects, pressure coils for use with concentric current coils, and comparative tests between concentric and Duddell-Mather wattmeters. Other subjects taken up were calibration of reflecting concentric standard, wattmeters for high and for low power-factor measurements, double-element wattmeters for two-phase and three-phase power measurements and advantages of concentric construction. Use of reflecting concentric instrument as a standard ammeter for alternating currents was touched on and certain interesting facts brought out in connection with the construction of concentric non-inductive standards of low resistance and measurement of the phase errors in current transformers, and in the series coils of dynamometer wattmeters. An appendix was included. —*Journal of Inst. of Elec. Engrs.* (London), May, 1917.

Determination of Torque of Direct-Current Meters. —E. Alberti.—An ordinary spring dynamometer is used, in which the adjustment is made by turning a lever, which increases or decreases the tension of a spring to such an extent that the pointer is brought back to the zero mark. The tension of the spring is then a measure of the amount of the torque.—London *Electrician*, May 11, 1917.

Book Reviews

Transmission Line Co-ordinate Paper. Published by Raymond S. Brown, Columbus, Ind. Price, $1 per dozen sheets.

The use of this co-ordinate paper offers to electrical engineers a simple, rapid and theoretically exact method for finding the voltage and current at any point of a transmission line when these quantities are known at some particular point of the line. It is applicable to the solution of any transmission line in which it is necessary to take into account either of the shunt constants, capacity or leakage, and is adapted to lines of any length, construction, voltage or frequency, ranging from high-tension power lines at commercial frequencies to long telephone lines and cables. The solution, being graphical, may be applied by one who is not familiar with the higher branches of mathematics and avoids the handling of complicated equations and tables. The form of the sheet is such that it may be folded once and bound with typewritten matter in reports, etc. Complete instructions go with the sheets.

Interior Wiring and Systems for Electric Light and Power Service. By Arthur L. Cook. New York: John Wiley & Sons, Inc. 416 pages, 248 illustrations. Price, $2.

As a guide to modern practice in electric lighting and power applications and in the design and installation of the wiring for such purposes, this volume fills the need of electrical workers who wish to become familiar with good practice in these branches. The first eight chapters offer a comprehensive discussion of electric lighting systems, taking up in order incandescent lamps, arc lamps, principles of illumination, lighting accessories, fixtures, methods of calculating interior illumination, and outdoor lighting. The next three chapters cover motors for industrial purposes, motor-starting devices and controllers, and selecting motors for industrial purposes. The rest of the book is devoted to descriptions of apparatus and fittings for interior wiring, together with detail methods of calculating the sizes of circuits to meet various requirements. Examples illustrate each step. Of particular value to the electrical worker are the many diagrams of connections, illustrations of electrical apparatus and fixtures, curves and tables.

Books Received

Public Utility Rates. By Harry Barker. New York: McGraw-Hill Book Company, Inc. 388 pages. Price, $4.

Examples in Battery Engineering. By Prof. F. E. Austin. Published by the author. 90 pages, illustrated. Price, $1.25.

Hydroelectric Practice. By D. H. Braymer and W. T. Taylor. New York: McGraw-Hill Book Company, Inc. 416 pages, illustrated. Price, $5.

Organization in Accident Prevention. By Sydney Whitmore Ashe. New York: McGraw-Hill Book Company, Inc. 130 pages, illustrated. Price, $1.50 net.

The Application of Hyperbolic Functions to Electrical Engineering Problems. By A. E. Kennelly. New York: The McGraw-Hill Book Company, Inc. 302 pages, illustrated. Price, $2.50.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ASSOCIATED MANUFACTURERS' MEETINGS AND ELECTIONS

Gathering of the Board of Governors and Dinner to Chairmen of the Various Sections—New Officers of Sections

The board of governors of the Associated Manufacturers of Electrical Supplies met at the association offices, New York, June 20. H. B. Crouse, the president, presided and there was a full attendance. Many matters of importance were considered and a number of new lines of activities were planned. The board will hold no meetings during the summer months, unless by special call; the next regular meeting will be in September.

DINNER TO SECTION CHAIRMEN

On the evening of June 20 the various chairmen of sections were the guests of the board of governors at a round-table dinner at Delmonico's. C. E. Patterson, comptroller General Electric Company and chairman of the cost accounting committee in the Electrical Manufacturers' Council, was also a guest, as were the cost experts of the companies of the section chairmen. Mr. Patterson discussed the matter of cost accounting very fully, inviting comments from those present and explaining in detail many points of interest. A number of other matters of importance to the sections were discussed and various section activities were planned.

BUREAU OF INDUSTRIAL STATISTICS CONSIDERED

The outlet box section held a regular meeting on June 19 at the association offices. Frank W. Hall, Sprague Electric Works, chairman of the section, presided, and practically all members of the section were present. Many subjects of importance were discussed. Among other activities considered was the establishment of a bureau for industrial statistics, which will be handled through the office of the general secretary.

MEETING OF PORCELAIN SECTION

The porcelain section held its regular meeting at the association offices on June 21. J. E. Way of R. Thomas & Sons Company, chairman, presided. The various standing committees made reports and other matters of importance were discussed. The regular election of officers was postponed until the next regular meeting.

OFFICERS IN OTHER SECTIONS

At recent meetings of sections elections of officers were held for the coming year as follows: Attachment plug section, H. W. Bliven, Harvey Hubbell, Jr.; fan-motor section, John H. Barker, Diehl Manufacturing Company; fuse section, H. R. Sargent, General Electric Company; knife-switch section, J. H. Trumbull, Trumbull Electric Manufacturing Company; lamp receptacle and socket section, W. D. Steele, Benjamin Electric Manufacturing Company; lighting fixture section, A. F. B. Harraden, Shapiro & Aronson; panelboard and switchboard section, Charles L. Eidlitz, Metropolitan Electric Manufacturing Company; snap-switch section, E. Whitmore, Manhattan Electric Supply Company.

TRIBUTE TO SAMUEL INSULL ON TWENTY-FIFTH ANNIVERSARY

Quarter of a Century as Executor of Chicago Companies—Business Growth Results in Properties Capitalized at $445,000,000

Officers and directors of the Commonwealth Edison Company celebrated the twenty-fifth anniversary of Samuel Insull's presidency of the company and its predecessors by giving an "Edison family birthday party" at Customers' Hall in the Edison Building, Chicago, on June 25.

In addition to local employees and friends a number of others were invited. John W. Lieb, New York, and W. W. Freeman, Cincinnati, were among the out-of-town guests. Thomas A. Edison in expressing regret that government business prevented his attendance proclaimed Samuel Insull as "the greatest business man in America to-day." The directors presented Mr. Insull with beautiful candelabra.

In an address acknowledging the tributes Mr. Insull reviewed the gigantic growth of the company and its predecessors as well as of the other corporations composing what is commonly called "the Insull group." These companies have an aggregate capital of $445,000,000 and the gross annual turnover is $75,000,000. On the average this shows that the companies turn over their capital about once in six years. Mr. Insull said this record is not so bad when it is considered that theoretically the companies should turn over their capital once in five years. The companies pay a little less than $5,000,000 in taxes and serve 1,500,000 customers living within an area of between 58,000 and 60,000 square miles. They have between 20,000 and 25,000 employees. While these figures appear great, Mr. Insull predicted that captains of industry twenty-five years hence would regard them in the same light that we look upon the amount of capital and labor employed in businesses of the past.

Mr. Insull in a family talk with the young men said that it is a mistaken idea to believe that the opportunity in big business is less than in smaller concerns. The greater the amount of capital employed, the greater will be the price paid for brains to direct it. His experience had shown that it is not necessary to go afar for brains to direct great business. Assuming that the financial plan is fundamentally sound, it is possible for men of average foresight and ability chosen from the ranks of companies associated and absorbed to rise to the greater tasks of directing the business of the greater consolidated properties.

URGENT TRANSMISSION AND DISTRIBUTION PROBLEMS

Cable and Insulator Problems Principal Subjects Discussed at Special Meeting of A. I. E. E.—President Buck on Prominence of Engineers

To meet the urgent requirements of the electrical industry, the special meeting of the American Institute of Electrical Engineers held in New York June 27 and 28 was turned over to the discussion of cable and insulator problems, the best forms of power for operating bituminous coal mines, and the economical combination of water-power and steam plants. The first day's session was devoted to the first two subjects, these being treated almost exclusively from the practical standpoint. Seven papers were presented by engineers connected with prominent operating companies or institutions closely related thereto. Abstracts of these papers, as well as of two of the other four presented at the second day's session, are given on pages 1256 to 1259 inclusive.

Just after the opening of the first session Captain Gustave Paul Capart of the French Scientific Commission was called upon by President H. W. Buck for some word from the front. In responding Captain Capart extended greetings from the electrical engineers of France and said the war was one of engineers which America must help to win for democracy.

The Engineering Profession

In presenting his annual address on the evening of June 27, President H. W. Buck said in part:

"The engineering profession has passed through the preliminary stages of its growth and has reached the position where the engineer should work and act not only with proper attention to his work itself but with full consciousness of the important relation of his work to human affairs in general. Under the stress of commercial development and economic conditions, increasing specialization has taken place, and the engineer has become obliged to compass his mind with an ever-narrowing horizon. This specialization produces extraordinary proficiency in particular fields, but has the objectionable effect of narrowing the character and outlook of the man and of reducing his value as a citizen.

"The evils of specialization are being offset to a great extent, however, by the growing recognition of the fact that all branches of engineering are interdependent. This co-operative movement has quite recently had tangible expression in the formation of the Engineering Council, which represents about 30,000 engineers of sufficient scope and standing to create an engineering public opinion. Its influence is likely to be far-reaching in building up the prestige of engineers in both technical and civic affairs. A further development which has reached full recognition only in recent times is the mutual appreciation which has grown up between the engineer and the worker in pure science.

"From all the important movements which are taking place at the present time, and which center around the engineer and his work, I believe that the engineer is soon going to leave his position of isolation in independent fields of work and realize that he owes an obligation to the community broader than his daily engineering work. It matters not whether the problems before him are political, sociological, industrial or technical, I believe that the engineering type of mind, with proper breadth of view, is fitted to undertake them.

"Engineering training gives mental balance, the power of analysis, resourcefulness and the faculty of recognizing and promptly apportioning the various elements in a problem. Furthermore, scientists and engineers as a class have a strongly developed spirit of international understanding, a sympathy which may serve as an important safeguard against excessive nationalism and aggression.

"Out of this world chaos we now see men of engineering and scientific training rising to positions of commanding prominence on all sides. In this great movement not only must the individual engineer play his part, but the great engineering societies must realize the power of influence which they are developing in an ever-increasing degree in the community and the obligations which devolve upon them.

"And so I hope that the American Institute of Electrical Engineers as it passes along from one administration to another will acquire an increasing realization of its duty, not only in furthering the growth of science and engineering, but in furthering the influence of the engineer in the affairs of the country and of the world."

The Engineer and the War

President-elect E. W. Rice, Jr., on being introduced, voiced his indorsement of all that President Buck had said regarding the function of the engineer and the engineering profession, and expressed his appreciation of the great honor conferred on him by the Institute and his realization of the responsibility that goes with the position. Speaking on the text that war is a business and must be handled as a highly organized, centralized autocratic enterprise, Mr. Rice touched on the relations of the engineering profession to the present war. He decried the popular notion that the war will be settled quickly by some wonderful new invention or by the act of some hero or superman. He felt, however, that the war can be fought to a successful issue if the country is content to solve it by the simple, common-sense methods used by engineers and successful business men. He confessed that he had nothing theatrical, startling or novel to suggest, and said that if the problem is first carefully investigated and all available data are quickly obtained and checked and all new conditions considered, a broad-gaged, well-considered plan or plans could then be formulated, criticized and put into effect. This, if followed with patience, persistence and diligence, will prove successful and the war cannot be lost. Mr. Rice said that there is no question in his mind that all of the problems of the war involving the aeroplane, army, navy, food, manufacturing, farming, transportation, etc., can be successfully solved by scientific but simple and common-sense methods. All men must, however, co-operate and be ready to make reasonable compromises in a spirit of conciliation. Engineers, he said, have a great opportunity in this war and a heavy responsibility too. They have special knowledge, experience and a forward-looking point of view which the country needs, and it is their duty to see to it that they receive the opportunity to make effective use of their talents in the service of the nation so that our civilization shall prevail.

Past-president C. O. Mailloux, who was the next speaker, told of the need of France for electrical engineers and asked for volunteers, not necessarily for the trench warfare, but back of the firing line to do the reconstruction work so greatly needed.

QUESTIONNAIRE ON FUEL FOR NATIONAL UTILITIES COMMITTEE

Full Data Desired by Committee on Coal Production of the Council of National Defense

The National Committee on Gas and Electric Service has sent a questionnaire on fuel to the electric and gas utilities. The data which it requests are desired for information and guidance of the committee on coal production of the Council of National Defense. Utilities are asked to return the forms at once to the committee headquarters, 1111 Munsey Building, Washington, D. C. In its circular the committee says:

The fuel questionnaire is designed to include a plant generating both gas and electricity. There is no objection to using two blanks, one for the gas division and the other for the electric division of a company. It would be important, however, for the electric division to indicate whether it obtained coke or water-gas tar from the gas manufactured in the generation of steam.

On Sheet 2 it will be noted that the entire coal year is included and there are two columns, one for the estimate and one for the actual results. Only two months of actual results can be reported, April and May, but the estimates should be filled in for the entire year. By the third day of each month the monthly statement should be sent to the secretary, 1111 Munsey Building, Washington, D. C., of the stock on hand on the first day of the month, together with the amount of fuel received under contract for the previous month and the amount of fuel received from other sources, per cent contract received for month and year, and reason shipper gives for shortage, if any. In this way the exact conditions of your coal stocks can be easily kept in Washington on the original form (Sheet 2) with the least amount of clerical labor, so that if you have any difficulty with your coal supply your joint committee will have full information for prompt attention to any request from your company for assistance in maintaining the fuel supply for public service.

Coal Report—Utility Companies Represented by National Committee on Gas and Electric Service

Fuel Data in Net Tons, 2,000 lbs. for "Coal Year" April 1st to April 1st. Date _____ **Sheet No. 1**

Reporting Company _____ Manufacturing Gas and Electricity

Address No. _____ Street _____ Place _____ County _____ State

Fuel Officer _____ Title _____ Telephone No. _____ Home Telephone _____

Electricity Generated K. W. H. _____ Annual _____ Max. Day _____ Min. Day

Gas Made, Cubic Feet _____ Annual _____ Max. Day _____ Min. Day

Surplus Coke for Sale _____ Annually. Surplus W. G. Tar _____ Coal Tar Sold _____ Annually

Do you produce Benzol or Toluol? _____ How much per annum? _____ By what process? _____

Drip or Holder Oil Recovered _____ Enriching Oil used per annum _____ B. t. u. or C. P Standard req'd _____

No.	ITEMS	State Grades of Fuel, Coal, Coke, Oil or Tar normally used or desired in Coal Year 1917-18					
		A	B	C	D	E	F
1.	Contractor's Name Address						
2.	Coal Company's Name Address						
3.	From What Mine						
4.	Mining District and State						
*5.	Original Shipping Point						
*6.	Rail Lake Canal Trucking						
7.	Is Routing Same Winter and Summer						
8.	If Not, Why						
9.	Can Plant Receive by Rail and Water						
10.	Net Tons Required in Coal Year						
11.	How Much Has Been Contracted For						
12.	What Grade Fuel Might be Substituted						
13.	Are There Local Sources of Supply						
14.	Specify How Fuel Could be Routed Differently						
15.	Total Storage, Excluding Station Bunkers						
16.	Method Used in Handling Fuel						
17.	Any Affiliations With Other Utilities Capable of Supplying Fuel; Give Kind, Quantity and Grade						
18.	State KIND of Gas Produced (if steam is produced Note same.)						

*REMARKS—Full information required including originating line, connecting lines and line to destination.

Fuel Data Reported by Company _____ Coal Year 1917-18. Sheet No. 2

No.	GRADE OF FUEL	A		B		C		D		E		F	
		Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual
19.	In Storage April 1st, 1917												
	April Receipts a/c Contracts												
	" " from other sources												
20.	In Storage May 1st, 1917												
	May Receipts a/c Contracts												
	" " from other sources												
21.	In Storage June 1st, 1917												
	June Receipts a/c Contracts												
	" " from other sources												
22.	In Storage July 1st, 1917												
	July Receipts a/c Contracts												
	" " from other sources												
23.	In Storage August 1st, 1917												
	August Receipts a/c Contracts												
	" " from other sources												
24.	In Storage September 1st, 1917												
	September Receipts a/c Contracts												
	" " from other sources												
25.	In Storage October 1st, 1917												
	October Receipts a/c Contracts												
	" " from other sources												
26.	In Storage November 1st, 1917												
	November Receipts a/c Contracts												
	" " from other sources												
27.	In Storage December 1st, 1917												
	December Receipts a/c Contracts												
	" " from other sources												
28.	In Storage January 1st, 1918												
	January Receipts a/c Contracts												
	" " from other sources												
29.	In Storage February 1st, 1918												
	February Receipts a/c Contracts												
	" " from other sources												
30.	In Storage March 1st, 1918												
	March Receipts a/c Contracts												
	" " from other sources												
31.	In Storage April 1st, 1918												

REMARKS:

ILLINOIS CONTRACTORS

State Convention to Organize the Industry on Sound Basis

Manufacturing, jobbing, central station and contracting interests worked together at the convention of the Illinois Electrical Contractors' Association, Peoria, June 22 and 23, to make effective plans for better organization in the electrical industry.

President J. N. Pierce, Chicago, stated that the aim of the convention was to lay plans that will revolutionize methods in the industry. Col. Robley S. Stearnes, New Orleans, president National Electrical Contractors' Association, in a "heart-to-heart talk," declared that the contractor-dealer, the man who has heretofore been kicked from pillar to post, is about to come into his own. Colonel Stearnes predicted that the industry will be organized so that each branch will perform its logical function.

William L. Goodwin, New York, was introduced as "the man who is out to organize the industry on a practical commercial basis." Mr. Goodwin advised contractors to organize local and state associations which will be interrelated with the National Electrical Contractors' Association and will have as their purpose study and discussion of the industry problems and topics which will make better business men of retailers who are failing to-day through ignorance.

The contractors decided to appoint three committees to forward the work. One will meet with the Illinois State Electric Association, one will work for increased membership, and one will be a committee on co-operation to meet with Mr. Goodwin.

INDIANA COMPANIES JOIN FOR INCREASE IN RATES

General Appeal to Public Service Commission Follows Warning by That Body Against "Outrageous" Coal Conditions

The Indiana Electric Light Association has filed with the Indiana Public Service Commission a petition asking authority for companies to add a temporary surcharge of 30 per cent to each bill for services of any kind rendered by them to any customer. General operating expenses have increased 45 to 50 per cent over normal times, the petition avers.

The executive committee of the association met in Indianapolis on June 22 and later conferred informally with Chairman E. I. Lewis of the commission. High cost of fuel is the principal factor responsible for the movement of the companies. No indication was given by the chairman as to what attitude the commission will take.

The Indiana commission, however, as the vehicle of the recent investigation of the "outrageous" coal conditions in the State, frequently warned the public that continued high prices of coal were likely to result in widespread petitions from utility companies for increased rates.

The proceeding is an unusual one since it involves the question of a blanket increase in rates for many companies, thus precluding, probably, appraisal of all properties affected.

PROSPECTS FOR COAL FOR THE ELECTRICAL INDUSTRY

F. S. Peabody, Chairman Committee on Coal Production of the Council of National Defense, Believes Plants Will Be Provided For

F. S. Peabody of Chicago, now resident in Washington, chairman committee on coal production of the Council of National Defense, is of the opinion that the electrical industries will obtain all the coal necessary for their needs, according to a statement made by him this week to a representative of the ELECTRICAL WORLD.

"Nothing definite in regard to coal for any of the industries can be done until Congress passes the necessary legislation granting the required powers," Mr. Peabody said, "but we have with us here in Washington George W. Elliott, secretary National Committee on Gas and Electric Service, as a member of the committee on coal production. He was especially named to represent these industries by J. W. Lieb, chairman of the national committee, when I wrote the latter asking him to name some one to represent these industries. Mr. Elliott is an active member of our committee, and he will get all he wants in the way of coal for the electrical industries, inasmuch as he has my full committee behind him."

In explaining that Mr. Elliott is working hard for priority of the electrical industries in the supply of coal, Mr. Peabody would hazard no guess as to how these industries will stand on the list when it is finally made up. Much will depend upon just what powers Congress grants.

On the other hand, the coal producers, 600 in number, have been meeting in Washington during the last week, at the Department of the Interior, with government officials and the committee on coal production of the council, and hearings have been begun before the Senate committee on interstate commerce—the Newlands committee—on the recent report of the Federal Trade Commission recommending a pooling arrangement of operation by the government of transportation and coal mines. President Wilson has, moreover, created during the past week an "Exports Council," under which the shipment abroad of commodities, including coal, is to be licensed by a board, and it is expected that exportation of coal will be under control of this board within a few days.

The coal operators had some plain talk from Secretary Lane and Secretary Daniels.

NEW YORK EDISON PLAN DENIED BY COMMISSION

Public Service Body Holds Company to Tentative Promise of Further Reduction in Maximum Rate on July 1

After presentation of the reasons why the New York Edison Company desired release from its tentative promise to reduce rates further the Public Service Commission, First District, decided that the changes in operating cost did not justify abandonment of the tentative agreement of last November. Directors of the company accepted the decision of the commission to this effect, and the maximum rate will be lowered to 7 cents per kilowatt-hour on July 1.

President N. F. Brady said in a letter to the commission:

> As you have fairly stated, this company, under the agreement which became effective Jan. 1, 1917, has the option on July 1 of reducing its maximum rate to 7 cents a kilowatt-hour, or of returning to the former schedule under which the maximum rate was 8 cents a kilowatt-hour. We have endeavored to show that a reduction under the existing conditions is unwarranted, but the commission has held that it is warranted. We are therefore prepared to accept this decision and reduce our rates to 7 cents a kilowatt-hour, with the understanding that if the results are of an adverse nature we may exercise the existing option and restore our former schedule of 8 cents a kilowatt-hour on Jan. 1, 1918.

NEW YORK TO HOLD ITS ELECTRICAL EXPOSITION

The 1917 Display Will Show How Electricity Makes Industry and the Home More Efficient and Economical

Arrangements are being made for the New York Electrical Exposition of 1917. The aim will be to show how electrical energy places industrial, commercial and home activities upon a higher plane of efficiency and economy. Exhibits will show methods of conserving life and health, increasing efficiency in manufacturing and commerce, eliminating coal waste, aiding medicine and surgery, and many other applications of electrical energy. Government exhibits are particularly appropriate, and efforts will be made to show the many uses of electricity in the army and navy. Electrically operated office and accounting machinery will be displayed, and the many uses of household appliances will be a particular feature. The electric vehicle display will be an important part of the exposition.

ELECTRIC RATE INCREASE BY THE TOLEDO COMPANY

Commercial and Industrial Light and Power Schedule Raised from 10 to 20 Per Cent, Beginning July 1—Domestic Rate Unaffected

Commercial and industrial light and power rates will be increased from 10 to 20 per cent by the Toledo (Ohio) Railways & Light Company, beginning on July 1. An announcement by the company said this is necessary because of the heavy increase in cost of operation. In the change the company has endeavored to make a more equitable adjustment of rates among patrons. About 5000 consumers will be affected.

The domestic rate, 7 cents per kilowatt-hour, has not been changed. The Public Utilities Commission has approved the schedule filed with it.

ELECTRICAL CONTRACTORS SAY "BUSINESS MUST GO ON"

Executive Committee of National Association, Meeting in Chicago, Enters Campaign to Forward the Interests of the Organization

A resolution expressing the opinion of the executive committee of the National Electrical Contractors' Association that "Business must go on" and that the annual convention should be held as planned was passed by the committee at Chicago on June 19 and 20. It follows:

Whereas it is of the highest importance that the United States having entered into the great war should use every endeavor to bring it to a successful issue, and whereas this can only be accomplished by every individual and every business concern doing its utmost to "keep business going" and endeavoring by every available means to increase the business of the country so that it can carry the necessary financial burden,

Resolved, That the N. E. C. A. hold its annual convention at the time and place already agreed upon, to wit, in New Orleans, La., Oct. 10 to 13.

Resolved, That the N. E. C. A. pledges its active support to the movement by which every business man agrees to do his part in carrying on mercantile enterprises, including the preparation of all electrical systems for the added demands which may be made upon them.

The meeting of the executive committee was the regular quarterly gathering. It was held at the La Salle Hotel. There was a full attendance and many subjects of utmost importance to the contractors were discussed and will be put in the proper channel for action at the New Orleans convention. This was the most successful meeting ever held by the executive committee. An extensive nation-wide propaganda was entered into which is expected to put the association on an equality with the foremost organizations of the country.

By invitation there were present W. L. Goodwin, New York; J. M. Wakeman, general manager Society for Electrical Development; E. McCleary, Detroit; Louis Kalischer, New York; Ernest Freeman, Freeman-Sweet Company, Chicago, former president of the association, and Mr. Hilton, treasurer of the organization, Syracuse.

Col. Robley S. Stearnes, New Orleans, the president, used every endeavor to have the association keep up its work, assured the committee that New Orleans was ready in every manner to receive the membership, and expressed the hope that each member would remember that the convention is to be very important. He said each member should make every reasonable sacrifice to attend, especially for the reason that there will be brought up for final action a complete change in the constitution and by-laws. A majority of the membership demands this and it will be settled at New Orleans.

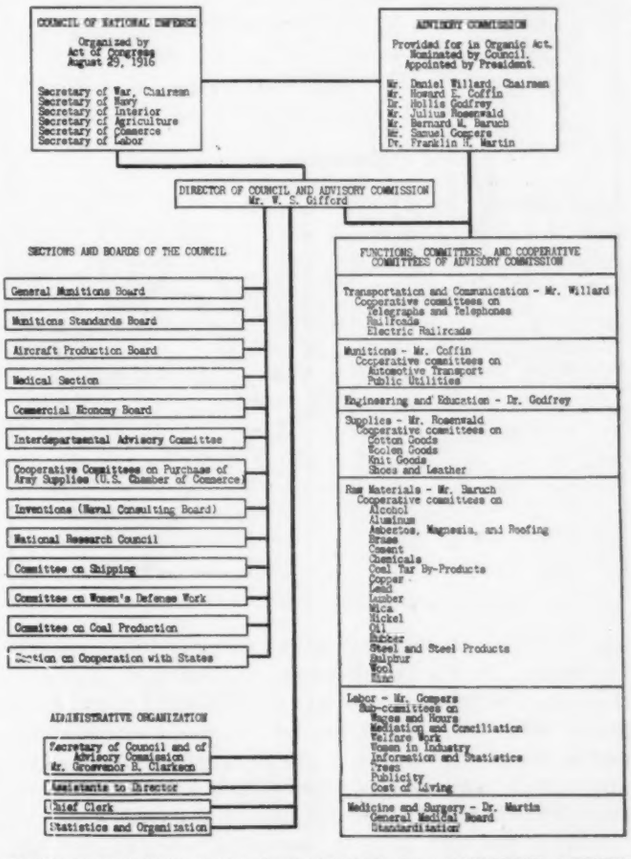
The slogan adopted by the executive committee was "Business Must Go On."

The National association is working along lines of profitable standardization and closer relations between manufacturers, jobbers, central stations and electrical contractors.

FAR-REACHING WORK OF THE NATIONAL DEFENSE COUNCIL

Report of Director Gifford on the Comprehensive Organizations Formed to Assist the Government—Affects Electrical Industries

Walter S. Gifford, director of the Council of National Defense and of its advisory commission, has made a



THOROUGHLY ORGANIZED, THE COUNCIL IS A POWERFUL AGENCY

report to Secretary of War Baker, chairman of the council. The report summarizes the far-reaching work of the Council of National Defense.

Strike at General Electric Plant Settled

A strike of machinists in one of the plants of the General Electric Company at Schenectady has been settled and the men have returned to work. Satisfactory arrangements have been made by which the cause of the difficulty has been overcome.

NEW ENGLAND POWER COMPANY TO SPEND $7,000,000 ON PLANT

Important Extensions of Generating, Transmission and Substation Facilities Planned for Immediate Future

Important extensions of the generating plant, transmission and substation facilities of the New England Power Company, representing an estimated cost of about $7,000,000, are planned for the immediate future. The urgency of the coal situation in New England and the rapidly increasing demands upon the company for power are making plant expansion necessary as soon as it can be accomplished.

The total generating capacity now owned by the company in hydroelectric and steam-driven stations supplying energy in five of the six New England States and also in New York State is 70,000 kw. Through reciprocal power contracts the company also is electrically in

touch with plants whose installed capacity totals 100,000 kw. more. In the twelve months ended May 31, 1917, the output of the company was 271,000,000 kw.-hr., compared with 203,000,000 kw.-hr. in the corresponding period the year previous, or an increase of 35 per cent. The recent peak load reached 67,000 kw. At present the output is about 1,000,000 kw.-hr. a day.

Within the last year in New England the average cost of coal has risen from about $4 per ton to a present price of $9. New business in industrial lines has increased throughout the territory, and it is now planned to raise the transmission pressure from 66,000 volts to 110,000 volts, to increase the capacity of the substations in Worcester, Mass.; Pawtucket and Woonsocket, R. I., and to build a hydroelectric station of 22,000 kw. initial capacity in the upper Deerfield valley in Vermont. The operating head at the new plant will be from 300 ft. to 325 ft. As yet no contracts have been placed for electrical or hydraulic equipment.

The capacity of the Woonsocket and Pawtucket substations will be 12,000 kw. and 30,000 kw. respectively. To improve the power factor of the system a 7500-kw. General Electric synchronous condenser is being installed at the Greendale substation in the Worcester district and a duplicate is being installed at Woonsocket. About $100,000 will be expended in increasing capacity of the Greendale substation from 11,000 kw. to 24,000 kw., and about $225,000 will be devoted to Rhode Island substation enlargements. A new substation is to be built at North Adams, Mass., at a cost of $75,000. The immediate generating facilities to be provided will add a generating capacity of 150,000,000 kw.-hr. to the system, and will mean the further saving of 300,000 tons of coal annually in New England. The output last year prevented consumption of 450,000 tons of coal, so that with completion of the extensions planned the company will save New England from consuming 750,000 tons of coal a year, or 15,000 50-ton carloads.

In all new power contracts the company now inserts a coal clause based on the price of coal at tidewater in Providence, R. I. With the base price of coal between $4 and $4.50 per ton at this point no change is made in the power rate, but above $4.50 an additional charge is made at the rate of 0.01 mill for each cent increased cost per ton, and below $4 a corresponding deduction is scheduled. This change in rates is figured on a plant economy of 2 lb. of coal per kilowatt-hour, which gives the small-plant owner the benefit of the better efficiency of a larger station in comparing his fuel-cost increase under local operation with the company's differential.

GOOD CONVENTION OF THE INDIANA COMMERCIAL MEN

Co-operative Government Supervision and Rigid Standardization by the Manufacturers Are Advocated by F. S. Hunting

Eighty-six representatives of electric central station and manufacturing companies registered for the Fort Wayne meeting of the new-business committee of the Indiana Electric Light Association on June 20.

Through all papers and discussions there were frequent references to methods of increasing central station loads without great expenditures for construction. N. A. Perry of Indianapolis read the leading paper on this topic. New-business department efficiency and methods of selling appliances also were dwelt upon.

In an after-luncheon address F. S. Hunting, general manager Fort Wayne works of the General Electric Company, advocated with earnestness co-operative government supervision and rigid standardization in the manufacturing business. Milton Henoch of East Pittsburgh advocated calling appliance salesmen "demonstrators" and decried the practice of wasting manufacturers' sales literature.

Niagara Power Situation

As this issue of the ELECTRICAL WORLD went to press the Niagara power companies had not received information from Washington of extension of the temporary permit of the War Department under which they have been receiving an additional 4400 cu. ft. of water per second from the Niagara River. The permit under which this water has been diverted expires on July 1.

MIDDLE WEST UTILITIES RESULTS OF OPERATIONS

Details of Sources of Gross Earnings of Holding Company—Common-Stock Dividend Policy Outlined by Mr. Insull

The total income of the Middle West Utilities Company in the year ended April 30 was $1,824,069. The company has followed the practice, unusual for holding companies, of stating the general sources from which this amount was obtained. They are given in the annual report to shareholders as follows:

INCOME		
Interest received and accrued on bonds and debentures	$564,789	
Dividends received and accrued—		
On stocks of subsidiary companies	$600,071	
On stocks of outside companies	12,851	
	612,922	
Sundry interest on notes receivable, brokerage, etc.	189,454	
		$1,367,165
Profits derived from sale of properties and securities to subsidiary companies and others, for cash	127,233	
Profits derived from sale of properties and securities to subsidiary companies where proceeds in bonds have not yet been sold	98,042	
		225,275
Profit arising from revaluation of securities and from valuation of securities hitherto carried at nominal values—values determined by board of directors	159,304	
Securities received for services rendered and valued by board of directors	37,500	
		196,804
Fees for engineering and other services to the subsidiary companies		34,825
		$1,824,069
EXPENSES		
Administration expense	$170,344	
Miscellaneous charges, including taxes, etc.	86,913	
		257,257
		$1,566,812
Interest on collateral notes and bonds	$424,375	
Interest on collateral loans, etc.	115,852	
		540,227
Net income for year, carried to surplus account		$1,026,585

The balance in the surplus account as of April 30, 1916, was $1,398,356, which, with the $1,026,585 from the year just closed, gave $2,424,941. Dividends on the preferred stock were $645,862 and on the common $142,130, a total of $787,992. After an appropriation of $90,000 toward writing off the discount on the company's own securities the surplus as of April 30, 1917, was $1,546,949.

MR. INSULL ON THE COMPANY'S PROGRESS

Samuel Insull, the president, says in part:

"Gross earnings of subsidiary operating companies have been very satisfactory, amounting to $9,620,216, of which only $388,960 came from newly acquired operating companies. Operating companies have necessarily felt the increased cost of practically everything used in their operation. The increase in their aggregate operating expense ratio, however, only amounted to 1.63 per cent over that of the previous year. Under normal conditions the expense ratio would have decreased, as a result of the increase of $1,140,107 in gross earnings of operating companies owned for the entire period. Notwithstanding the increase in expenses the net earnings from operation of all subsidiary companies were very satisfactory and amounted to $3,502,756, an increase of $424,995 over the fiscal year ended April 30, 1916. It is anticipated that the increase in gross earnings and the practice of strict economy in the operation of the subsidiary companies during the coming year will produce equally satisfactory earnings.

"During the fiscal year the company acquired the Kentucky Light & Power Company of Kentucky, the Central Power Company, operating in Nebraska, the Citizens' Gas Light Company of Jackson, Tenn., and the Houghton County Gas & Coke Company of Houghton, Mich. In addition a few small properties adjacent to existing operating companies have been acquired.

"Following an established policy of consolidating its small operating companies, in the interests of economy of operation, those in the State of Michigan, consisting of the Constantine Hydraulic Company, the Three Rivers Light & Power Company, the Three Rivers Gas Company, the Marquette County Gas & Electric Company, the Milling & Power Company and the Houghton County Gas & Coke Company, have been consolidated into the Michigan Gas & Electric Company. For the same reason the Freeport Railway & Light Company, the Tri-County Light & Power Company and the Illinois Northern Utilities Company were consolidated early in the current fiscal year under the name of the last-named company. All three properties were situated adjacent to one another in northern Illinois.

COMMON STOCK DIVIDEND POLICY

"In view of the company's rapid growth and the character of its business requiring large amounts of new capital from time to time, your directors gave careful consideration to the basic policy upon which dividends on the common stock should be disbursed. They concluded that a portion of the surplus earnings invested in the company and represented by stock dividends would accomplish the twofold object of lessening the requirement for outside capital and, by increasing the equity behind the company's senior securities, strengthening their standing. It was therefore decided that common stock dividends when declared should be made payable in cash and stock in such proportion as the requirements of the business would from time to time seem to make desirable. The present policy of the directors is to pay, as already stated on April 2 last, a cash dividend at the rate of 2 per cent per annum and a stock dividend at the rate of 2 per cent per annum. When the earnings of the company justify it the policy will probably be pursued of increasing the stock dividend rather than increasing the cash dividend.

"A list of the subsidiary companies shows that they regularly employ 2500 people and have an aggregate annual payroll of approximately $1,900,000. Rendering service to an estimated total population of 1,055,300, they have 131,000 electric, 43,000 gas, 16,600 water and 1900 heating customers. They transmit electrical energy, which is their principal business and which provides 55.9 per cent of their income, over 2473 miles of transmission lines and distribute it in 388 communities to a connected load aggregating 200,000 kw., or 268,000 hp. Connected to their distributing systems are 99,600 hp. of electric motors and 1121 electric cooking ranges, besides the domestic and municipal lighting loads of the communities served."

The various surplus accounts belonging to the company aggregate $3,456,977.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Negligence Involving Third Person.—An electric railroad is not liable for burns to a pedestrian coming in contact with loose wire which a third person had attached to a pole carrying the current of the railway, it was held by the Supreme Judicial Court of Massachusetts (116 N. E., 218). Where a car shifter for an electric railway was told that a trolley support was charged with electricity, and he knew that people would be likely to be in the vicinity thereof, and that wire had been dumped close to the post and that persons would suffer therefrom, and it was his duty to report the condition to his superior officer, and for a long time prior to the accident children and other persons without the railway's permission but with knowledge of the division superintendent and other employees had used the path, the conclusion was warranted that failure to report the condition constituted reckless or wanton negligence.

Provision of Safe Poles for Linemen.—The exception to the rule of duty of an employer to furnish employees a reasonably safe place to work, that it is not a company's duty to furnish a lineman a safe pole on which to work, is not applicable to defects in original construction, the Supreme Court of Vermont held (100 A., 762). The duty of employer as regards original construction is succeeded to by the successor in ownership and operation of the line as soon as it ought in the exercise of reasonable diligence to have learned of the defect. Risks which ought not to exist and would not but for the employer's negligence are not assumed by a lineman unless he knows and comprehends them or they are so obvious that the law will charge him with knowledge and comprehension. The employer being charged with duty to its employee lineman of original safe construction, the latter could assume that a pole was properly set till something came to his notice from which he ought, in the exercise of reasonable prudence, to have learned that it was not. If, however, he was inexperienced in the work and ignorant of the risks attending it and how to avoid them, and this ought to have been known by the employer, then he should have been cautioned and instructed regarding them. Instructions to linemen to make a personal inspection and examination of conditions of poles are not enough to charge a lineman with knowledge of what could be learned by digging to the bottom of a pole. A defect, though not obvious but latent and hidden, may be a risk ordinarily incident to the employment which a lineman assumes.

Injuries Received by Person on Private Ground Used by Public as a Common Highway.—A seventeen-year-old boy was not negligent as matter of law because upon a dark and stormy night he failed to see a broken electric wire lying in the grass, or because he mistakenly believed that sparks emanating from it were fireflies, the question whether he failed to exercise due care being a question for the jury, the Supreme Judicial Court of Massachusetts held (116 N. E. 251) in Bouthier vs. City of Malden. Whether the accident occurred within the limits of the highway or outside of it was for the jury. In such action evidence was held sufficient to justify finding that plaintiff's intestate was a traveler on the highway. In such action, where the first and second counts of the declaration alleged that decedent was a traveler on the highway and was injured by reason of a defect and want of repair in the way, but there was nothing to show when the wire was broken or how long it had been hanging in the street, and there was no evidence that the city knew or by the exercise of proper care and diligence might have had reasonable notice of a defect in the way, if such existed, verdict was rightly ordered for the city. If the poles and wires of the defendant electric company were maintained without permission of a town or a city, and without any permission it authorized another electric company to place wires upon its poles, negligence of the electric company was thereby shown. Though an electric company did not own high-tension wires below its own on its poles, if the high-tension wires were placed under its own with its knowledge, the electric company might be found liable for death of a boy from shock when he touched a wire of the electric company which had broken and fallen against the high-tension wires below, the insulation on which was defective, if the electric company failed to adopt such precautions as were reasonably necessary to avoid danger to persons lawfully traveling on the highway. If an open space between a house and an electric-wire pole had been used by the public as a playground and a common passageway, and had been used for travel by persons going from one street to another, and such uses had been made with the knowledge and consent of the owner, there was an implied invitation by the owner to the public to travel over the space, and doing so was not trespass. If electric companies maintained poles upon a highway and near the line between the highway and an open lot used by the public with the owner's permission, on which poles wires were attached carrying a high voltage of electricity, the companies were bound to exercise reasonable care to maintain their wires so that persons rightfully on the lot would not be injured. A boy on land in proximity to an electric-wire pole by the implied invitation of the owner of the land was there in the owner's right and had the same rights against electric companies whose wires were strung on the pole as the owner would have had.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Financing Southern California Consolidation.—The Southern California Edison Company has filed with the California Railroad Commission an application for authority to sell 15,000 shares of common stock at 88 a share, par value $100, the proceeds to acquire in whole or part $5,000,000 bonds of the Pacific Light & Power Corporation, to discharge obligations of that corporation, or to pay for additions and betterments to the Edison company's plant. The commission a few days ago authorized the company to issue 10,000 shares of this stock at 88. The company proposes to offer the 15,000 shares, together with the 10,000 shares previously authorized, to stockholders pro rata in proportion to their holdings, and that any stock not taken will be offered to others, including employees and patrons.

Transmission Line Law in Nebraska.—The ninth annual report of the Nebraska State Railway Commission comments as follows on the law providing for regulation of construction of high-voltage electric transmission lines outside of cities of the metropolitan, first class and second class, and putting the supervision and enforcement of that act upon the commission: "This legislation came at just the right time, for construction of high-voltage transmission lines has developed exceedingly during the two years since the enactment of the law. All indications point to a still more rigid development. The presumption is warranted that development of this kind will be one of the most marked characteristics of the next ten years. Construction to carry electric currents of highly destructive capacity should be made with due regard to the rights of other industries using overhead wiring, and also with due regard to the safety of the public. The act carries no specific penalties of its own for violations of its provisions. It provides that 'the provisions of the existing law with regard to appeal, penalties and other procedure before the State Railway Commission shall apply.' Since enactment of the law transmission lines have been constructed without the authority of the commission and without its knowledge. Since no orders had been issued by the commission in regard thereto the penalties of the railway commission act did not apply. If the act carried penalties of its own applicable to those who violated its provisions by constructing without the requisite authority from the commission, following the necessary showing as to specifications and location, these companies which in the last two years have ignored the law could be reached."

Dinner to Rotary Club After Demonstration.—As the concluding feature of an electrical appliance demonstration week recently the Albuquerque (N. M.) Gas, Electric Light & Power Company gave an electrically cooked luncheon to the Rotary Club.

Brooklyn Edison Directors.—At a meeting of the board of directors of the Edison Electric Illuminating Company of Brooklyn on June 18, Charles A. Boody and Herbert L. Bridgman were elected directors to fill vacancies created by the deaths of the late William Berri and William F. Sheehan.

Wisconsin Edison Company Reduces Dividend.—Directors of the Wisconsin Edison Company, Inc., declared a quarterly dividend of 50 cents a share, payable on July 16, as compared with $1 per share in the last quarter. Gross operating revenues in May were $966,073, an increase of 19.17 per cent over May, 1916; operating expenses were $709,989, an increase of 40.57 per cent; net revenues were $256,084, or a decrease of 16.20 per cent.

Sale of West Virginia Water Power Properties.—Public sale of the New Richmond and Hawk's Nest water power properties will be held on July 23 at Charleston, W. Va. These powers are located 42 miles apart on the New River. The United States government has just located its armor plate and munition works at Charleston. These plants are to be constructed at once at an estimated cost of $12,000,000. A statement from J. M. Morehead, People's Gas Building, Chicago, executor of the estate, says that the New Richmond falls are rated conservatively at 8500 hp. and the Hawk's Nest at 22,000.

Proposal to Change Cities Service Company Stock.—Abolition of the present par value of $100 and exchange of ten shares of new common stock without par value for each present share is recommended to directors of the Cities Service Company by a special committee. Application to the New York Stock Exchange to list preferred and common stocks of the company is also favored. Both matters were referred to counsel for report. A suggestion that debenture bonds be issued as a method of future financing of the company and its subsidiaries was reported adversely, so far as action at this time is concerned.

Anticipated Results in Associated Gas & Electric Company.—John H. Pardee, president Associated Gas & Electric Company, New York, in the seventh annual report, covering 1916, says: "In the matter of efficiency your company's properties are in better physical condition than ever before; the company is doing a larger volume of business, has greater capacity, more compact corporate organization, and should have a better opportunity for success than for a number of years. The constantly increasing cost of all kinds of fuel and operating supplies and the upward trend in wages will, however, very probably militate against improvement in the net results from operation so long as present abnormal conditions exist."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Ordinance Permitting Rate Cutting by Columbus Municipal Plant to Be Submitted to Referendum. — Mayor Karb of Columbus, Ohio, has signed the Holton ordinance, providing for submission to voters at the fall election of an amendment to the charter allowing the city to sell energy from the municipal plant below cost in order to compete with the privately owned plant and in this way build up patronage for the city's plant.

Colorado Power Company Reservoir Filled.—The Colorado Power Company reports that its largest storage reservoir, the Parker reservoir in Boulder County, Colorado, on which it mainly depends to supply power for winter electric service, was completely filled on June 18. In 1916 the reservoir was cut off to meet the needs of irrigation when it was only two-thirds full. Officers estimate that as a result of the early filling of the reservoir profits this year should be increased by $20,000 in comparison with 1916.

Oklahoma Gas & Electric Company's New Bond Issue.—William P. Bonbright & Company, Inc., and H. M. Byllesby & Company have underwritten and are offering a new issue of $2,500,000 two-year 6 per cent notes of the Oklahoma Gas & Electric Company. The proceeds will be used to retire outstanding 6 per cent debenture bonds, to create a fund from which to liquidate the floating indebtedness, including the cost of new properties, and for extensions and additions. The company has completed arrangements for acquiring the properties of the Enid Electric & Gas Company, the electric lighting business in Norman, Okla., and control by stock ownership of the Muskogee Gas & Electric Company.

General Gas & Electric Passes Dividend. — General Gas & Electric Company directors notified preferred shareholders in advance of the regular dividend meeting on June 29 that because of the extraordinary car shortage the company would have to pass the dividend. This dividend has been paid regularly during the last five years. The company has its own coal mine, and if cars could be obtained and deliveries assured within moderately reasonable time the dividend could be paid; but conditions are beyond control. The business of the company is expanding greatly as industrial operators appreciate the coal situation too well to try to meet their own power needs. Officials believe that more unified operation of railroads and control of coal supplies will be obtained with the advent of centralized control at Washington.

Investigation in Toledo.—Prof. Oscar Irvin and Prof. A. N. Laird of Toledo (Ohio) University, at the request of Dr. Milo R. Maltbie, who has been employed by the city of Toledo to assist in the readjustment of lighting rates with the Toledo Railways & Light Company, have been making an examination of the street lamps operated by the company. At a recent meeting of the Council committee on gas and light they testified.

Industrial Lighting in Ohio.—In order to further minimize industrial accidents, the Ohio Industrial Commission has arranged to have a light code prepared under its direction. Prof. F. C. Caldwell, Ohio State University, has been selected to head a committee, the other members of which are H. H. Craiglow, Buckeye Steel Castings Company, Columbus; S. E. Doane, National Lamp Works of the General Electric Company, Cleveland; George W. Walker, Cincinnati; H. L. Jenkins, Newark; Thomas J. Donnelly, secretary Ohio State Federation of Labor, and John Graney, labor representative, Youngstown.

Electric Car Makes Atlantic City Record Run.—That the electric automobile is adapted for long runs has been proved by a run from Atlantic City to New York City on June 19, under the auspices of the New York Electric Vehicle Association. The run was made in a Baker R. & L. stock car, model BX 7, a new model. The car left New York on June 18, driven by Edward Smith of the Baker R. & L. Company with Waldo W. Sellew, a passenger, as official observer for the New York Electric Vehicle Association. The run from Atlantic City to New York was made in five hours and fifty-eight minutes, actual running time, with a boost of one hour and a half at Lakewood. The mileage was 123½ miles, making the average running time 20½ miles per hour; 283 amp.-hr. were used, an average of 2.29 per mile, the cost of which at a 5-cent kilowatt-hour rate, the maximum charging rate in New York City, would total $1.55.

Cleveland Municipal Plant Coal Problems.—President Thompson of the Cleveland City Council has prepared a resolution to be offered at the next meeting which will request the large cities of Ohio to unite in an appeal to Governor James B. Cox to solve their fuel and power problems by establishing a State-owned power plant in one of the coal fields. Commissioner Davis said that coal for the municipal plant is now costing more than $5 per ton, but he expressed the belief that a plant in the coal field could produce energy at a rate low enough to permit its use for heating purposes as well as light and power. President Thompson has asked City Clerk Collins to obtain data from the Ontario Hydro-Electric Commission in regard to the distribution of energy from the Niagara Falls station. He contends that Cleveland must settle its fuel and power problems if it desires to continue its present industrial growth and progress and that cost of energy must be within reason.

Norwegian-American and Canadian Engineers and Architects.—An informal congress and reunion of American and Canadian engineers and architects of Norwegian birth or descent will be held in Chicago, Sept. 27-29, at the Chicago Norske Club.

Dallas Electric Club and Jovian League.—The manufacture of raw-water ice with electric power was the subject of a talk given before the Dallas Electric Club and Jovian League by C. S. Dawley, assistant general manager of the Southern Iced Utilities Company, June 18.

Connecticut Electric Light Association.—Lightning protection was the subject of an illustrated talk given by Dr. E. C. Creighton, General Electric Company, at a recent meeting of the Connecticut Electric Light Association. Officials of several Connecticut utility companies were present.

Minneapolis Jovian League. — The Minneapolis Jovian League held a combination educational and entertainment meeting on June 21 at which Martin J. Wolff of St. Louis was the principal speaker. The league is laying plans for a big electrical palace at the Minnesota State Fair this summer.

Public Service Electric Company Section, N. E. L. A.—At the June 18 meeting of the Public Service Electric Company section of the National Electric Light Association Sergeant Major Nelson of the Canadian army spoke on "Trench Life and Trench Warfare in France." P. S. Young, vice-president of the company, spoke on "Liberty Loan Subscriptions by the Company and Its Employees." It was brought out that 65 per cent of all the employees subscribed for bonds amounting to $670,350. In addition to this the company subscribed for $100,000, making a total of $770,350. The following officers were elected: Chairman, M. P. Pembleton; first vice-chairman, E. W. Kent; second vice-chairman, F. B. Burrows; secretary, R. T. Rossi.

American Society for Testing Materials.—The twentieth annual meeting of the American Society for Testing Materials was held June 26 to 29 at Atlantic City, N. J. Among the subjects discussed which were of interest to electrical engineers are the following: "Electrical Insulation," C. E. Skinner; "Corrosion of Iron and Steel," S. S. Voorhees; "Some Applications of Magnetic Analysis to the Study of Steel Products," C. W. Burrows; "Interior Surface Defects in Brass Condenser Tubes as a Cause of Corrosion," W. Reuben Webster; "The Hardness of Hard-Drawn Copper," D. H. Peirce; "The Electrolytic Determination of Tin on Tinned Copper Wire," George G. Grower; "Preservative Coatings for Structural Materials," E. H. Walker; "Lubricants," C. C. Van Gundy; "Comparison of the Heat-Insulating Properties of Materials Used in Fire-Resistive Construction," W. A. Hull; "Refractories," A. V. Bleininger, and "Suggested Improvements in the Manufacture of Silica Brick," C. E. Nesbitt and M. L. Bell.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Cleveland Engineering Society.—To give the public a better idea of the nature and importance of the service rendered by engineers the Cleveland Engineering Society has issued in magazine form, under the title of "The Conquerors," a series of articles on the work of the engineer.

Jovian Electric League of Los Angeles.—At the weekly meeting of this association held in Los Angeles June 13 Charles L. Logan, Los Angeles County Recorder, spoke on "Safeguards to Be Observed in Dealing in Real and Personal Property." H. W. Doubrara, local manager of the Wagner Electric Manufacturing Company, acted as chairman of the day.

Louisville Jovian League.—Members of the Louisville Jovian League are making elaborate preparations for an excursion on the Ohio River. Numerous electrical appliances, donated by electrical appliance dealers of the city, will be given to excursionists who hold lucky numbers. W. D. Myers of the Louisville Gas & Electric Company is chairman of the committee which has charge of the excursion.

Electrical League of Cleveland.—Ward Harrison, illuminating engineer of the National Lamp Works, General Electric Company, addressed the Electrical League of Cleveland June 17, the subject being new departures in the use of light, particularly for industrial purposes. The previous week's meeting was a record affair as a demonstration of enthusiasm. The total sales of the Liberty bond sale campaign amounted to tween $75,000 and $100,000. At the recent annual meeting of the Electrical League of Cleveland J. M. Bateman was elected president for the coming year.

Society of Industrial Engineers.—The Society of Industrial Engineers, consisting of professional technical engineers, accountants, managing executives in commercial and industrial activities, technical writers, educators and students, was organized in Washington, D. C., on June 15. It is planned to tender the services of the organization to the government through Howard E. Coffin, chairman of the advisory committee, Council of National Defense, and such other committees as can utilize the services of industrial engineers. A bureau has been organized under the direction of the president of the society to list all the industrial specialists in the country who may be called upon to serve either as advisers or actual directors of efficiency work. D. C. Dent, Chicago, is acting secretary of the organization.

Associated Electrical Contractors.—At a recent meeting of the Associated Electrical Contractors of Paterson and Passaic, N. J., resolutions were adopted offering the services of the members of the association as a whole to the mayors of the cities represented. H. W. Desaix is secretary of the association.

Engineers' Club of Columbus, Ohio.—Under the direction of President E. G. Bradbury the Engineers' Club of Columbus is making an excellent growth, although organized only two months ago. It already has 125 members, and it is hoped to increase the number to 300 by the end of this month. The officers are working on plans to make the club of particular service to the community in assisting in the solution of civic problems.

Lynn Section, A. I. E. E.—At the annual meeting of the Lynn Section of the American Institute of Electrical Engineers, held on June 20, talks were given by Walter C. Fish, manager of the Lynn works, and R. C. Ellis of the standardizing library. Officers were elected for 1917-1918 as follows: Chairman, J. M. Davis; secretary-treasurer, R. D. Tomson, and executive committee, H. A. Warren and C. A. B. Halvorson.

Society for the Promotion of Engineering Education.—The annual meeting of the Society for the Promotion of Engineering Education will be held in Washington, D. C., on July 6 and 7 in connection with the educational committee of the advisory commission of the Council of National Defense, instead of in the Northwest as formerly planned. The topic which will be discussed at this meeting is "The Relation of the Engineering School to the National Government During the Present Emergency." F. L. Bishop is secretary of the society.

National Electrical Credit Association.—The eighteenth annual meeting of the National Electrical Credit Association was held June 28 and 29 at the Boston City Club, Boston. The hotel headquarters were at the Copley-Plaza. The annual meeting was an innovation this year, as it was the first time that a fixed program had been scheduled. Among the subjects that were discussed at this meeting were the following: "The Scope of the Electrical Credit Association," by Guy V. Williams, New York City; "Trade Acceptances," by J. D. Meek, Indianapolis Electric Supply Company; "What and Why Is the Cash Discount?" by David Kerr, Lewis Electrical Supply Company, Boston; "Should Interest Be Charged on Overdue Accounts?" by D. E. Crane, Macbeth-Evans Glass Company, Pittsburgh; "The Small Risk—Definition, Exploitation and Control," by R. P. Tracy, Joseph E. Greene Company, Boston; "Contractors' Accounting Methods—The Best Credit Barometer," by J. W. Smith, General Electric Company, New York City, and "Municipal Mumps—Prevention and Cure," by J. F. Thomas, Elliott-Lewis Electrical Company, Philadelphia. Norman I. Adams, manager credit department of National Shawmut Bank, was scheduled to address the meeting on Thursday, June 28.

HENRY D. SHUTE

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Henry D. Shute, who was last week promoted from treasurer to vice-president of the Westinghouse Electric & Manufacturing Company, has been associated with the company since 1893. Mr. Shute was born in Somerville, Mass., and was graduated in electrical engineering from the Massachusetts Institute of Technology in 1892. He later spent some time studying in Germany at the school of mines in Clausthal and also at the technical school in Dresden. He has had a wide and varied experience in the Westinghouse company. His first two years were spent in the testing department, he being later engaged on erection and laboratory work. Subsequently he became associated with L. B. Stillwell. For a short time afterward he was an assistant foreman of the experimental department in the Niagara Falls power plant work. Later he was transferred to the engineering department, where he designed alternating-current apparatus, being prominently identified with the steam railroad electrification work done by the Westinghouse company. After five years' service with the company he took up work in the sales department, in which he remained until 1903, when he was made assistant to Vice-President L. A. Osborne, which position he filled until 1910, when he was elected acting vice-president. In 1914 he was made treasurer of the company, succeeding T. W. Siemon. Mr. Shute has always taken an active interest in civic and other outside affairs. He was a member of the Pittsburgh committee on the Anglo-French loan, and more recently served on the manufacturers' committee which was so successful in securing the large over-subscription by Pittsburgh to the Liberty Loan bonds.

James L. Stone, new-business manager of the Mansfield (Ohio) Electric Light & Power Company, was recently elected president of the Mansfield Jovian League of America.

William P. Guinan, new-business manager of the Danbury & Bethel Gas & Electric Light Company, was recently re-elected chairman of the mercantile bureau and director of the Chamber of Commerce of Danbury, Conn.

Morris Schaff has been reappointed by Governor McCall to the Board of Gas and Electric Light Commissioners of Massachusetts.

James G. White, president of J. G. White & Company, Inc., New York City, was recently elected second vice-president of the Merchants' Association of New York for the ensuing year.

Lewis A. McArthur, general manager of the Pacific Power & Light Company, Portland, Ore., has been elected a member of the executive committee of the Northwest Electric Light and Power Association, to take the place of J. E. Davidson, resigned.

J. N. Moncrieff has resigned as local manager for the Wisconsin-Minnesota Light & Power Company at La Crosse, Wis., to become connected with a New York utilities company. Prior to going to La Crosse in the fall of 1914 he was manager of the electric lighting plant at Bloomington, Ind.

Gen. George H. Harries, president of the Louisville Gas & Electric Company and vice-president of H. M. Byllesby & Company, has volunteered for service in the federal army, of which he is a retired Major General. He expects to be assigned for duty shortly. He has a leave of absence from the Byllesby company, to which he will return after the war.

W. A. Wadsworth, who for several years has been directing the electric sales force of the Union Gas & Electric Company of Cincinnati, Ohio, has resigned to accept a position as manager of the Kansas Gas & Electric Company's property at Wichita, Kan. Mr. Wadsworth went to Cincinnati from the Alabama Power Company three and a half years ago. For two years before that he was acting sales manager of the Schenectady (N. Y.) Illuminating Company.

James T. Hutchings, who has been general manager of the Rochester (N. Y.) Railway & Light Company since early in 1909, has been elected vice-president and general manager of the company. Shortly after graduation from the Massachusetts Agricultural College at Amherst in 1889, Mr. Hutchings became connected with the Thomson-Houston company. He was later appointed assistant superintendent of the West End Electric Company, Philadelphia, then superintendent until the Philadelphia Electric Company was organized in 1897, when he was appointed its electrical engineer. In 1904 he became superintendent of the electrical department of the Rochester company and, two years later, he was promoted to be assistant general manager.

WALTER CARY

Walter Cary, who since 1904 has been associated with the Westinghouse Lamp Company, filling for the greater part of the time the position of vice-president and general manager, last week was elected a vice-president of the parent company, the Westinghouse Electric & Manufacturing Company. Mr. Cary was born in Milwaukee, Wis., and received his education in the schools of that city and at Harvard University. After leaving college he became associated with the Gibbs Electric Company of Milwaukee as secretary, and in 1889 he, with some other local men, formed the Milwaukee Electric Company, manufacturer of dynamos and motors, becoming its vice-president and in 1902 becoming president.

George H. Sampson has recently resigned as assistant to C. H. Austin, electrical engineer and contractor, Nashua, N. H., to accept the appointment of electrical engineer for the Public Service Commission of New Hampshire, with headquarters in Concord.

D. T. Millican has resigned as chief of the power department of the Choctaw Portland Cement Works, Hartshorne, Okla., to take a similar position with the Denver Cement Corporation. He will be stationed at Superior, Neb., in charge of the Nebraska Cement Company's plant.

Howard A. Holmes has been appointed assistant electrical engineer of the Mahoning & Shenango Railway & Light Company at Youngstown, Ohio. He was formerly with the company, but left about eight years ago for another connection. Of late he has been with the aeronautic station of the Pensacola navy yard.

Herbert Thacker Herr, who has been identified with the Westinghouse Machine Company since 1908, filling respectively the positions of general manager, second vice-president and general manager, and finally vice-president and general manager and a director of the company, was elected last week a vice-president of the Westinghouse Electric & Manufacturing Company. Mr. Herr was born in Denver, Col., and received his education in the public schools of Denver and at Yale University.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

A STILL HIGHER PRICE IS EXPECTED IN WIRING SUPPLIES

Advances on Galvanized Iron Conduit, Sockets, Plugs, Receptacles, Switches, Etc., May Be Announced Very Soon

Higher prices on certain items of wiring supply are expected in some parts of the trade. How long before these advances will be announced is not known, but it is believed that higher prices will be put into effect very shortly.

One item on which an advance is looked for is galvanized iron conduit. So far both galvanized and black conduit have been selling at the same price, although the demand for galvanized far outstrips that for the black. No such increase is expected on the black, but only on the galvanized, for which the bulk of the demand exists.

There is also a strong feeling that another advance can be expected in sockets, switches, plugs, receptacles and such material. The prices that manufacturers have had to pay for labor and material, especially brass, are believed to be such that higher prices will be necessary. Only a couple of weeks ago one of the New England manufacturers of this class of material withdrew all quotations, and this manufacturer now accepts orders subject to the previous price at the time of the receipt of the order.

CLOSER CREDIT CO-OPERATION AMONG ELECTRICAL JOBBERS

Risk Involved by Contractors and Dealers Purchasing Apparently Legitimate Amounts from More Than One Firm

It has not been unusual for contractors and dealers, particularly those newly started, to become heavily obligated to some jobber and then when they have reached the end of their credit with him to go to another jobber and run up a second account. For the jobbers this is a very dangerous practice. The risk run by the first jobber may have been reasonable and legitimate, but the additional credit given by other houses acts against all to whom the buyer is indebted.

For this reason co-operation among jobbers in spreading credit information is growing. On the Pacific Coast this form of co-operation has become very definite. If a customer becomes heavily obligated to some jobber and is unable to keep his account in proper shape, the account is allowed to remain with that jobbing house and the other electrical supply men refrain from accommodating that customer or taking his trade until his financial affairs are again in a stable condition.

There is, however, another side to this situation that is undoubtedly far more dangerous to the jobber than the condition above cited, that arising when a contractor or other buyer purchases apparently legitimate amounts from a number of supply men and manufacturers. He may be a reasonable thousand-dollar risk, but as a matter of fact his obligations may be running nearer $4,000 to $5,000. A few years ago it would have been impossible to detect such a condition because of the absolute lack of credit information co-operation. Now, however, that jobbers and manufacturers realize the benefits to be derived from such action it is not so difficult to find out a buyer's obligations to other supply men. There are, however, so many supply houses and so many manufacturers from whom a contractor or dealer may obtain credit that the chance of obtaining exact information is not yet very great. Probably the most successful plan yet developed to take care of such cases is the trade acceptance system. The banks on which the acceptances are drawn will be able to tell very quickly if the merchant is exceeding his ability to pay promptly.

THE STANDARDIZATION OF TRADE LITERATURE SIZES

A. M. E. S. Committee Recommends 8 Inches by 10½ Inches for Letter Paper, Catalogs, Bulletins and Various Other Forms

Standardization of sizes for trade literature has received considerable attention recently from the electrical industry, and it is becoming more and more evident that some definite and concrete action will result before long. The committee appointed by the Associated Manufacturers of Electrical Supplies has, after a careful study, submitted the following report and recommendations to the board of governors of the association:

"Your committee on the standardization of letter paper, catalogs, price lists, etc., has tabulated the replies received from various manufacturers and begs to submit herewith the results attained.

"The sizes of letter paper given are taken from actual measurements made by the committee, and while the dimensions, 8½ in. by 11 in. (21.59 cm. by 27.94 cm.) are those given by a majority of the manufacturers for letter paper and are also the dimensions recommended by the Electric Power Club, as forwarded to you in Mr. Dustin's [secretary of the association] original letter of April 26, your committee proposes to recommend to the Manufacturers' Council that the dimensions of 8 in. by 10½ in. (20.32 cm. by 26.67 cm.) for letter paper, catalogs, bulletins, contract forms, specifications and engineering forms be adopted as our standard for the following reasons:

"1. A large portion of the manufacturers in replying to Mr. Dustin's request for data stated that they would be glad to adopt any standard dimensions recommended by the committee.

"2. The 8-in. by 10½-in. (20.32-cm. by 26.67-cm.) sheet has approximately 10 per cent less paper than the 8½-in. by 11-in. (21.59-cm. by 27.94-cm.), and in times of conservation of resources it is believed that economy is an important consideration from a general-welfare point of view. One manufacturer estimates that this item alone will save his company $12,000 a year, and all manufacturers are vitally interested in a saving of this nature.

"3. Our investigations indicate that these dimensions have been adopted as the United States government standard.

"4. As a rule photographs of electrical apparatus are made on 8-in. by 10-in. (20.32-cm. by 25.4-cm.) plates, and it being a simple matter to trim the finished prints 8 in. by 10½ in. (20.32 cm. by 26.67 cm.), this size of photograph lends itself to binding with other papers of these standard dimensions.

"5. The American Institute of Architects has recommended the size of 8 in. by 10½ in. (20.32 cm. by 26.67 cm.) for all catalogs of building material, and this size of sheet permits the advantageous listing and displaying of electrical wiring devices and other building materials. A thin catalog of this size when folded once will fit readily the average pocket, whereas a 6-in. by 9-in. (15.24-cm. by 22.86-cm.) catalog when not folded will not fit in the pocket.

"6. The Electrical Supply Jobbers' Association has adopted as the standard for its loose-leaf catalog a page

8½ in. by 10 in. (21.59 cm. by 25.4 cm.), and the same plates used for printing a bound 8-in. by 10½-in. (20.32-cm. by 26.67-cm.) catalog can be very satisfactorily used for printing on the 8½-in. by 10-in. (21.59 cm. by 25.4 cm.) sheets of the Electrical Supply Jobbers' Association, thus leaving ample room for binding on the binding edge. It is customary in a catalog to leave a little greater border at the top and bottom than is found to be desirable in the jobbers' handbook sheets.

"7. This size of sheet for letter paper, catalogs, etc., will file much more readily in standard letter files than will the larger size.

"8. In addition to the actual saving in paper mentioned under No. 2, there would be an additional saving in envelopes and a very great saving in postage, due to reduced shipping weight of catalogs. The manufacturer referred to estimates that this additional saving in his particular case would amount to approximately another $12,000. The question of postage will probably become a very serious matter of expense to the manufacturer in the near future and should receive careful consideration.

"In conclusion: It has been argued that the paper mills adhere to certain long-established standard sizes for their kinds and grades of paper. On the other hand, those manufacturers who are using 8-in. by 10½-in. (20.32-cm. by 26.67-cm.) cut sheets have no difficulty in obtaining their paper at considerable saving, and the adoption of these dimensions by an association of the size of the A. M. E. S. will immediately lead paper mills to produce paper of proper size to cut up to these dimensions.

"As far as we are able to ascertain, any arguments in favor of the larger size apply equally well to the size which your committee recommends.

"With regard to price lists, your committee recommends the dimensions of 4 in. by 7 in. (10.16 cm. by 17.78 cm.), which dimensions have been adopted by the Electric Power Club and seem to be used by the majority of the members of our association."

GOVERNMENT DECIDES TO LICENSE EXPORTS

Action Taken, Among Other Things, to Prevent American Products, Including Electrical Goods, from Reaching Germany

Definite information is now at hand at the Department of Commerce at Washington that a large quantity of American products, including certain lines of electrical goods, are finding their way into Germany through neutral channels, in spite of the fact that the United States and its allies are using every means at their disposal to prevent supplies from entering enemies' territory. It is undoubtedly true that American electrical manufacturers have had no reason to believe that their exports were going to other than neutral countries.

To prevent American exports from entering Germany the government at Washington has taken steps in the last week to direct American exports. An Exports Council has been authorized to act in an advisory capacity to the President in this matter. The object of the council is threefold—to regulate the amount of exports on such commodities as are needed in this country, to regulate the tonnage, and to prevent supplies from reaching Germany.

In explaining the executive order creating the council President Wilson has issued a statement from which the following is quoted:

"There will, of course, be no prohibition of exports. The normal course of trade will be interfered with as little as possible, and so far as possible only its abnormal course directed.

"This policy will be carried out, not by prohibitive regulations, therefore, but by a system of licensing exports, which will be as simply organized and administered as possible, so as to constitute no impediment to the normal flow of commerce.

"The free play of trade will not be arbitrarily interfered with; it will only be intelligently and systematically directed, in the light of full information with regard to needs and market conditions throughout the world and the necessities of our people at home and our armies and the armies of our associates abroad."

This action of the American government will undoubtedly go a long way toward eliminating the official supervision now exercised by the English government over all exports to neutral European countries. It seems most probable that there will be set up in the principal export ports of the country local officers to go over the exports and officially license them. In this way considerable time will, of course, be saved, inasmuch as Great Britain will no longer have occasion to interfere with American goods in their progress to countries not at war.

FREIGHT SITUATION IS BECOMING BETTER

May Statistics Indicate a Reduction Amounting to Approximately One-Third in the Railway Car Shortage

One of the greatest difficulties to be met by manufacturers has been the freight situation. The shortage of available rolling stock has slowed up the transportation both of raw materials and of finished product. The situation, however, seems now to be much improved.

A letter has been sent out by the American Railway Association regarding the freight car shortage and is quoted in part as follows:

"The shortage of freight cars in the United States was reduced during the month of May from 148,627 to 105,127 cars—almost one-third.

"The progressive improvement in the situation is indicated in that on March 1 reports made by railroads to the American Railway Association showed a shortage in the entire country of 130,082 freight cars. The shortage grew to 144,797 by April 1, and on May 1, when the railroads' war board was just starting to operate all the railroads as a continental system with the aim of producing a maximum national transportation efficiency, the shortage had reached 148,627 freight cars."

METAL MARKETS CONDITIONS

Copper Prices Expected to Go Below 30 Cents on Government Price Announcement

For the most part the market in metals of the different industrial classes is dull. Buyers are still awaiting the action of the government.

There is a feeling that the government will probably pay between 20 and 25 cents a pound for copper. This, it is believed, will have the general effect of bringing copper prices below the 30-cent level. As an indication of this belief electrolytic fell more than half a cent during last week.

Nominal quotations on electrolytic copper on Monday last were as follows: June, 32.37½ cents; July, 31.5 cents; third quarter, 30.5 cents; fourth quarter, 29 cents.

NEW YORK METAL MARKET PRICES

	June 18 Selling Prices Bid	Asked	June 25 Selling Prices Bid	Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	31.00	to 32.00†	30.50	to 31.50†
Electrolytic	32.50	to 32.75†	32.25	to 32.50†
Casting	30.00	to 31.00†	30.00	to 30.50†
Copper wire base	37.00	to 38.00†	37.00	to 38.00†
Lead	11.00		11.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.42½	to 9.55	9.30	to 9.42½
Tin, Straits	63.00†		62.87½†	
Aluminum, 98 to 99 per cent.	56.00	to 58.00†	56.00	to 58.00†
OLD METALS				
Heavy copper and wire	27.75	to 28.25	27.75	to 28.00
Brass, heavy	17.50	to 18.00	17.50	to 18.00
Brass, light	14.50	to 14.75	14.50	to 14.75
Lead, heavy	10.00	to 10.25	10.25	to 10.50
Zinc, scrap	7.00	to 7.25	7.00	to 7.25

†Nominal.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 solid:	
Less than coil	+10% to $54.90 Net
Coil to 1000 ft.	3% to 48.80 Net
No. 12 solid:	
Less than coil	+10% to 63.90 Net
Coil to 1000 ft.	3% to 56.80 Net

Twin-Conductor

No. 14 solid:	
Less than coil	+10% to $78.00 Net
Coil to 1000 ft.	3% to 75.00 Net
No. 12 solid:	
Less than coil	+10% to 121.00 Net
Coil to 1000 ft.	3% to 108.00 Net

CHICAGO

Single-Conductor

No. 14 solid:	Discount
Less than coil	Net to +10%
Coil to 1000 ft.	10% to 15%
No. 12 solid:	
Less than coil	Net to +10%
Coil to 1000 ft.	10% to 15%

Twin-Conductor

No. 14 solid:	
Less than coil	Net to +10%
Coil to 1000 ft.	10% to 15%
No. 12 solid:	
Less than coil	Net to +10%
Coil to 1000 ft.	10% to 15%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20% to 12%
1/5 to std. pkg.	10% to 20%
Std. pkg.	24% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+10% to +20%
1/5 to std. pkg.	10% to 20%
Std. pkg.	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 50	.30	.30
50 to barrel	.28	.28 to .29
Barrel lots	.24	.25

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.35	$0.35
12 to 30	.30	.30
50 to barrel	.25½ to .26¼	.26½ to .27¼
Barrel lots	.24 to .24¾	.25 to .25¾

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25-50	35.00
2	25-50	45.00
2½	25-50	52.00

DISCOUNT—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip		
⅜-in. double strip		
½-in. single strip	Net to 10%	7% to 20%
½-in. double strip	Net to 5%	4% to 15%

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$71.25 to $75.00	$60.00 to $63.75
⅜-in. double strip	75.00 to 78.75	67.50 to 71.25
½-in. single strip	95.00 to 100.00	80.00 to 85.00
½-in. double strip	100.00 to 105.00	90.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot	Size, in.	List, per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

DISCOUNT—NEW YORK

Less Than $15 List	$15 to 60 List	$60 to $150 List
Net to 33⅓%	45% to 50%	53% to 55%

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$36.67	$27.50	$23.10 to $24.75
¼-in.	40.00	30.00	25.50 to 27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, in.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37
2½	.58½
3	.76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.60
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	6% to 8%	8% to 10%
2500 to 5000 lb.	9% to 11%	11% to 13%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ In. to ½ In.	¾ In. to 3 In.
Less than 2500 lb.	3.8% to 7.8%	5.8% to 9.8%
2500 to 5000 lb	6.8% to 10.8%	8.8% to 12.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

Net	$3.15 to $3.50

CHICAGO

Net	$3.75 to $3.85

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.75 to $6.30
1/5 to std. pkg.	4.50 to 5.25

Standard package, 500. List, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.05

105 to 125 Volts

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.17
Coil to 1000 ft.	21.00 to 26.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$37.20 to $38.16
Coil to 1000 ft.	27.90 to 28.62

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$18.00 to $29.00

CHICAGO

Net per 100	$20.00 to $28.35

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, A.X. 1½, 4 S.	30.00
103—C.A., 9, 4 R., B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	List to 33%	List to 27%
$10.00 to $50.00 list	42%	18% to 37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40% to 43%	35% to 37%
$10.00 to $50.00 list	50%	40% to 48%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $20.00
1/5 to std. pkg.	13.00 to 15.80

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$14.00 to $18.00
1/5 to std. pkg.	13.00

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	5½ N.C.—Solid Std.Pkg. 3500	Nail-It—N.C. Std.Pkg. 4000
Less than 1/5 std. pkg.	$10.50 to $24.30	$21.10
1/5 to std. pkg.	9.75 to 12.15	28.00

CHICAGO

Per 1000 Net	5½ N.C.—Solid Std. Pkg. 3500	Nail-it—N.C. Std. Pkg. 4000
Less than 1/5 std. pkg.	$8.40 to $18.00	$20.75 to $28.00
1/5 to std. pkg.	7.80 to 9.75	16.30 to 21.50

SOCKETS AND RECEPTACLES

	Std. Pk.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pg.	Net list
1/5 to std. pkg.	15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	List
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

Less than $10 list	....
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

DISCOUNT—CHICAGO

Less than $10 list	+5% to 5%
$10 to $25 list	11% to 16%
$25 to $50 list	14% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp., three-point	100	.56
10-amp., three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net list to +20%
1/5 to std. pkg.	Net list to 15%
Std. pkg.	30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 23%	Net to 18%
$2.00 to $10.00 list	23% to 50%	18% to 40%
$10.00 to $50.00 list	23% to 60%	18% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 50%	20% to 40%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

Net price	$2.10 to $3.50

CHICAGO

Net price	$2.80 to $3.50

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.52 to $0.62
No. 18, full spools	0.48 to 0.53

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.565 to $0.6885
No. 18, full spools	0.495 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-18.00	$12.00-14.50	$11.50-12.50
12	21.06-27.05	18.96-22.85	18.01-20.95
10	29.60-39.27	26.64-33.66	24.68-25.31
8	42.40-51.44	38.16-48.42	33.51-36.25
6	72.19-89.57	64.98-76.80	56.63-61.73

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$16.00	$14.00
12	25.92-29.89	21.96-25.62	19.44-23.48
10	36.48-42.28	30.84-36.24	27.36-33.22
8	43.80-60.13	40.15-51.54	35.77-47.25
6	69.24-82.20	63.47-68.00	56.55-68.50

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$40.25 to $45.00
25 to 50 lb.	39.25 to 42.00
50 to 100 lb.	38.00 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$42.35 to $45.50
25 to 50 lb.	41.35 to 44.50
50 to 100 lb.	40.35 to 43.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

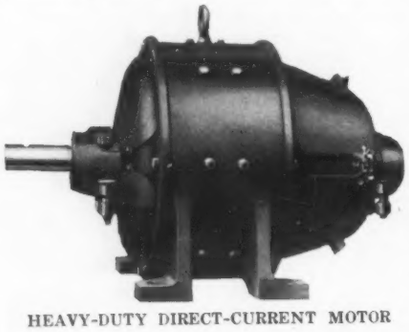
Circulating-Water Heater

A combined circulating-type water heater and temperature-control device which may be attached to any ordinary kitchen hot-water tank has been developed by the Automatic Electric Faucet Company, San Francisco, Cal. No heating coils are used in this apparatus, the heat being produced by electricity passing through the water between a carbon cylinder and a graphite electrode. Either 220-volt or 110-volt alternating current can be employed satisfactorily. The power demand can be adjusted by changing the size of the electrodes. A Kercher temperature-control switch is employed. To minimize the radiation of heat from the tank and circulating pipe they are covered with an asbestos coating.

TEMPERATURE-CONTROL HEATER

Direct-Current Motor for Heavy Duty

A new direct-current motor designed especially for heavy duty work and known as the type "T" is being manufactured by the Reliance Electric & Engineering Company of Cleveland, Ohio.

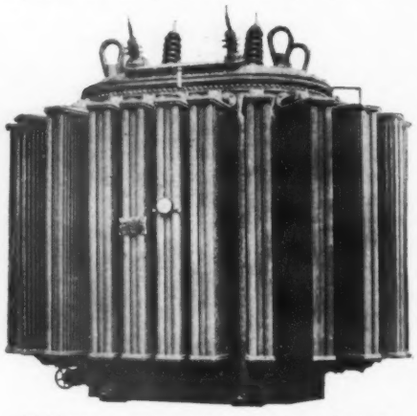


HEAVY-DUTY DIRECT-CURRENT MOTOR

Cast-steel frames are used on the machine and the specially heavy feet are cast integral with the frame. Four laminated poles are supplied on all frames and secured by large cap screws. Soft open-hearth steel is used on the commutating poles, and the field coils are particularly well insulated to adapt them to severe service. The bearings are ring-oiled, and a deep oil well with a sediment pocket is provided on each bearing. The armature coils are built up of electrical sheet-steel punchings, insulated with core-plate varnish. The motor is intended primarily for use in iron and steel mills, railway shops and machine shops.

Mammoth Self-Cooled Transformers

Six of the largest self-cooled transformers in the world, aggregating 48,000 kva., have been built by the General Electric Company of Schenectady, N. Y., for the Carnegie Steel Company, Each transformer is a single-phase, 25-cycle, 8000-kva. unit and steps the voltage from 44,000 to 6600. A unique feature of these transformers is the use of twenty-four external radiators which are attached to the containing tank, giving a radiating surface of approximately 1,000,000 sq. in. (6,452,000 sq. cm.). Cooling is obtained by an automatic circulation of oil through the radiators. All of the principles and characteristics of the circular-coil, type H design with the circular disk-coil interleaved windings and three-legged core were incorporated.



8000-KVA. SELF-COOLED TRANSFORMER

The radiating units consist of vertical flattened tubes rigidly welded into headers which are flanged for bolting to the tanks. There are cast-iron elbows between the tank and each radiator, flanges being provided for bolting thereto. The absence of any screwed pipe fittings assures oil-tight joints, the manufacturer claims.

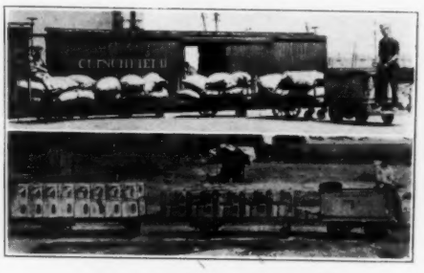
All seams and joints in the tank and radiators are welded to prevent oil leakage. None are soldered, brazed or riveted. The radiators are self-draining and have no pockets, which would accumulate air at the top or moisture and sediment at the bottom. These refinements have considerably increased the kilowatt-ampere rating of self-cooled transformers and made possible a wider latitude in their field of application.

Industrial Tractor

After a comprehensive study of problems involved in the short-haul movement of materials, the Lansing (Mich.) Company has developed and placed on the market a line of tractors like those shown. Two sizes have a rated capacity of trailer load of 5000 and 12,000 lb. respectively. The motor and control equipment, which was furnished by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., was designed especially for this type of service. One of the most important features of the tractor is the dividing of the battery into two parts connected in parallel, thus requiring resistance in the circuit only on the first notch of the controller.

When a standard automobile wheel is used for steering it is at the operator's right, with the controller handle. A lever, at the left, may be substituted for the wheel. The brake pedal is under the left foot. It is held by a latch and released by a slight shifting of the operator's foot. Interlocking of brakes and controller is a feature peculiar to this tractor. Setting the brakes automatically throws the controller to the "off" position and locks it.

A single steel casting forms the drive axle; it incloses all transmission gearing in an oil chamber and has a bracket to carry the motor. The front axle is of standard automobile construction and supports the frame through leaf springs. Short wheelbase and small over-all dimensions make turning easy in limited space. The standard equipment includes a lead storage battery, but a nickel-iron battery will be furnished on order.



INDUSTRIAL TRACTORS IN USE

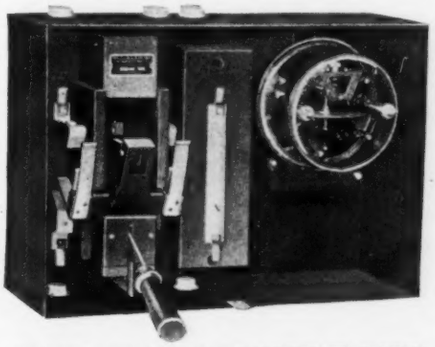
Industrial Truck Operable from Either End

Electric industrial trucks that may be controlled from either end have been developed by the Orenstein-Arthur Koppel Company of Koppel, Pa. Control is afforded by two pedals and the handles. This tractor can be operated in narrow aisles without turning, the operator merely changing his seat. The cells are divided between the two battery boxes carried on the truck platform, the larger box containing three trays of six cells each, the remaining six cells being housed in the smaller front box. The covers of the boxes serve as seats for the operator. Each tractor will push or pull 20,000 lb. (9071 kg.) at a maximum speed of 7 miles per hour. Twenty-four-cell, fifteen-plate Ironclad batteries of 220 amp.-hr. capacity are employed on account of the unusually heavy duty the tractors are called upon to perform.

Circuit Breakers for Polyphase Motors

Circuit breakers which are specially recommended for use with polyphase motors operating without supervision are being manufactured by the Palmer Electric & Manufacturing Company, Boston, Mass. The type Q breaker, which is especially adapted to this service, opens on phase reversal, upon the blowing of a fuse in one leg (provided the single-phase operation causes a load which would injure the motor), when the energy supply is interrupted or when trouble develops within the control coils or contacts.

The control equipment is mounted in a metal box arranged for open-wire or conduit connections, a slot being provided in the cover of the box, through which the operating handle projects. The arm carrying the breaker contacts is held closed by a relatively frictionless latch that is controlled by an electromagnet in circuit with the contacts of the relay. The relay consists of a standard watt-hour-meter element, without dial or gear train, carrying on its shaft a platinum bar that

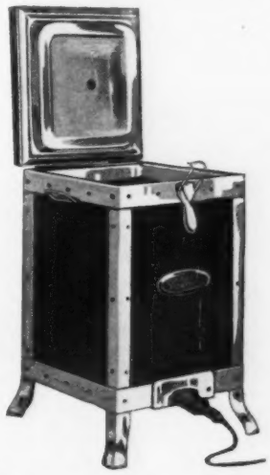


CIRCUIT BREAKER FOR POLYPHASE MOTOR

moves into or out of contact with two flexible tungsten contacts that complete the circuit to the control magnet in the breaker. With normal excitation the disk of the relay makes a partial revolution to a point where its contact is in such a position that the breaker may be closed. In the event of phase reversal the relay disk instantly revolves, thereby operating its contact, causing the breaker to open and locking the breaker against reclosing so long as the circuit is improperly excited for motor operation. Types S and T breakers made by this company are similar in appearance and construction, but the type S unit opens only on phase reversal.

Electric Cooker with Time Switch

An electric cooking outfit that combines the principle of the fireless cooker with electrically generated heat is now being built by the Standard Electric Stove Company of Toledo, Ohio. Food is placed in aluminum containers, which in turn are inserted in the range. The time clock is then set for a period of full heat in order to bring the "calorator" or heat distributer to cooking temperature. At the expiration of the time limit the switch automatically turns off the full heat produced by a 620-watt element and continues the heating with a 40-watt element, which remains in service until disconnected by the operator. It is claimed that the smaller element is sufficient to keep the stove at an effective cooking temperature for an indefinite period, thus making the operating cost very moderate.



COOKER THAT PREPARES A DINNER WITH A 40-WATT HEATER

Recording-Demand Watt-Hour Meter

Both energy consumption and integrated demand can be measured with the recording-demand watt-hour meter shown herewith. The total kilowatt-hours consumed are indicated on a four-counter dial, and the integrated demand over successive predetermined intervals is recorded on a chart. The apparatus may be installed as an ordinary watt-hour meter and requires no additional apparatus or wiring. The measuring and recording elements are mechanically interconnected and there are no contacts to become inoperative. The recording mechanism is controlled by a high-grade clock, and the measuring element is a standard Westinghouse type OA watt-hour meter with a special gear train.

Under load, the gear train of the

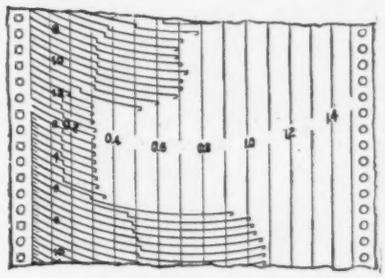
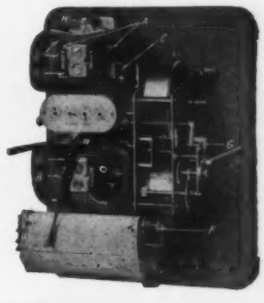


CHART RECORD OF DEMAND METER

watt-hour meter advances the counters in the regular manner. At the same time the gear train causes the ink-carrying pen to advance across the record sheet in proportion to the energy registered. At the end of a predetermined time interval a stud on the reset wheel releases the pen gear from mesh with the gear train, and a balancing weight returns the pen to zero where it is again meshed with the gear train to repeat its advance during the next time interval. Meters are made for fifteen, thirty or sixty-minute intervals, but any one of these meters may be converted to operate at any one of the other intervals.

Irrespective of the time interval of the meter, an operating spring controlled by the clock causes the paper to advance 1/16 in. every fifteen minutes. Thus if the meter is arranged to have a fifteen-minute interval the paper advances just before the pen is reset, so that the pen makes a distinct and readily observed record of the maximum pen travel. If the mechanism is arranged for thirty-minute intervals between resets the paper will advance one fifteen-minute space between periods, causing an offset mark on the chart at the middle of the thirty-minute interval. Three similar offset marks are produced each hour on the charts of meters designed for sixty-minute intervals. The



RECORDING-DEMAND WATT-HOUR METER

recording-demand watt-hour meter, which is known as type RA, is made by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

Trade Publications

STEEL FORMS.—A substitute for wood forms in constructing concrete work is the subject of a folder issued by the Blaw Steel Construction Company, Pittsburgh, Pa.

LIGHTING GLASSWARE. — Decorative glassware for use in connection with interior lighting fixtures is attractively illustrated in catalog No. 81 issued by the Macbeth-Evans Glass Company, Pittsburgh, Pa.

SOLDERING TOOLS. — Features, advantages and applications of various types of soldering tools developed by the Clemons Electrical Corporation, Buffalo, N. Y., are brought out in this company's catalog No. 2.

GRINDING AND BUFFING TOOL.—A self-contained motor-driven grinding and buffing machine is the subject of a folder recently issued by the United States Electrical Manufacturing Company, Los Angeles, Cal.

HEADLAMP LENS.—Some of the features of the Macbeth lens for use with automobile lamps having high intrinsic brilliancy are pointed out in catalog No. 109, issued by the Macbeth-Evans Glass Company, Pittsburgh, Pa.

METERS.—An improved form of recording-demand watt-hour meter is described and its operation explained in catalog 3-A, supplement 1, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

OIL ENGINES.—Features of construction and operation of the type FH oil engine, manufactured by the De La Vergne Machine Company, East 138th Street, New York City, are discussed in bulletin No. 166 issued by that company.

VENTILATING FANS.—The application of motor-driven ventilating fans to public assembly halls and other places is touched on in booklet 3429, which is being distributed by the Sprague Electric Works of the General Electric Company.

PORTABLE LAMPS.—Uses for a combined spot lamp, trouble lamp and automobile lamp are illustrated in a folder entitled "The Anderson Auto-Reel Spot-Lite," which has been prepared by the Anderson Electric Specialty Company, Chicago.

SWITCH COMPARTMENT UNIT. — Compartment-type assemblies of switches, relays, meters and instrument transformers are described in a leaflet entitled "High-Tension Interlocking Ironclad Cubicles," recently sent out by Ferranti, Ltd., Hollenwood, Lancashire, England.

ELECTRIC RANGE.—Some of the chief advantages of the Standard Electric Range are recounted in a folder recently mailed by the Standard Electric Stove Company, Toledo, Ohio. An electric cooker built on the fireless-cooker principle is described in another folder issued by this company.

BUSINESS HELPS.—A number of reprints of advertisements have been mailed by the General Electric Company, Schenectady, N. Y. These refer to its standard unit panels, wire and cable, graphic demand meter, floodlight projectors, Mazda lamps, fans, rock drill and fabroil gear.

SYNCHRONOUS MOTORS.—Advantages of synchronous motors in driving compressers, rubber mills, fans and blowers, high-pressure pumps, etc., are brought out in bulletin No. 168, recently prepared by the Electric Machinery Company, Minneapolis, Minn. Numerous curves that are useful in making motor calculations are included.

STOKERS.—Bulletin B-2, which has recently been sent out by the Combustion Engineering Corporation, New York City, contains a description of its type "E" underfeed stoker, which is particularly adapted to burning low-grade fuels. Attention is called to methods of distributing the air, regulating the air and coal supply, and operating under forced and natural draft.

BALL BEARINGS.—Precautions which should be taken in applying ball bearings to preserve their inherent efficiency are brought out in a folder entitled "How to Apply Them," which is being distributed by the Hess-Bright Manufacturing Company, Philadelphia, Pa. Another folder on the application of ball bearings to the airplane has also been mailed by this company.

VENTILATING EQUIPMENT.—"Westinghouse Electrical Equipment for Ventilating Service" is the title of an attractive pamphlet just issued by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., in its motor-applications circular No. 7193. Types of motors and controllers adapted to this service are briefly described, and the amount of power required to drive different types of fans and blowers is also given.

ELECTRIC RANGES. — The Hughes Electric Heating Company of Chicago has issued a forty-eight-page booklet entitled "What Every Kitchen Needs." Twenty-four pages of this book are devoted to the publication of electric cooking recipes by Alice Bradley, principal Miss Farmer's School of Cookery, Boston; Marion Harris Neil, former cookery editor *Ladies' Home Journal;* Janet McKenzie Hill, editor *American Cookery;* Mrs. E. K. Lemcke-Barkhausen, principal Greater New York Cooking School, and the Good Housekeeping Institute, Mildred Maddocks director. The remainder of the book is given over to illustrations and descriptions of the Hughes electric ranges. A feature of these descriptive pages is the legend near each picture which says: "See what 'Watt' means on page 47." On that page, for the edification of the non-electrical public, there is a simple explanation of the electrical term "watt."

New Incorporations

THE ELECTRIC SERVICE COMPANY of Quincy, Ill., has been incorporated with a capital stock of $2,500 by Abbott Merrylees, Matthew J. Dickman and others.

THE AMERICAN INSULATION COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of $10,000 by B. T. Conwell, Jr., and others. The company proposes to manufacture insulation specialties.

THE LIEBEL-FLORSHEIM COMPANY of Cincinnati, Ohio, has been chartered with a capital stock of $30,000 to deal in electrical appliances. The incorporators are: John G. H. Liebel, Edwin S. Florsheim, George Stugard and others.

THE MILLS ELECTRIC COMPANY of Lafayette, Ind., has been incorporated by Byron J. Mills, Herbert A. Keller and Eldon L. Lewis. The company is capitalized at $100,000 and proposes to manufacture automobile parts and accessories.

THE ROSS VULCANIZING & BATTERY COMPANY of Elmira, N. Y., has been incorporated with a capital stock of $10,000 by Harry M. Swartz, Leslie W. Jennison and Thomas M. Losie. The company proposes to operate a general garage.

THE MULTI-BATTERY SYSTEM of Wilmington, Del., has been incorporated by Herbert E. Latter, Henry A. Robinson and Clement N. Egner. The company is capitalized at $225,000 and proposes to manufacture battery systems, electrical machinery, etc.

THE AJAX ELECTRIC & MANUFACTURING COMPANY of Newark, N. J., has been chartered with a capital stock of $125,000 to deal in hardware, tools, etc. The incorporators are: Rudolph Bauman of Newark, W. W. Bliecke and R. S. Hicks of Orange, N. J.

THE STORAGE BATTERY SERVICE & SALES COMPANY of Memphis, Tenn., has been incorporated by W. H. Daniel, W. P. Metcalfe, Roger Stanley, Lake Hays and I. M. Craig. The company is capitalized at $5,000 and proposes to deal in storage batteries.

THE HOPPIE ELECTRIC WINDOW CONTROL, Inc., of Wilmington, Del., has filed articles of incorporation with a capital stock of $250,000 to manufacture a patented electric window control. The incorporators are F. D. Buck, M. L. Horty and K. E. Longfield of Wilmington, Del.

THE ELECTRIC CONTROL COMPANY of New York, N. Y., has been incorporated by Frank P. Fahay, Julius G. Acheves and George J. Gillespie, of 146 East Sixty-second Street, New York City. The company is capitalized at $10,000 and proposes to do a general contracting business and electrical work.

THE LIGHT FINDER SALES CORPORATION of New York, N. Y., has been incorporated with a capital stock of $1,000 to manufacture electrical apparatus. The incorporators are: Alanson P. White, D. Berkowitz and Alexander Aaronson. The company proposes to manufacture electrical apparatus.

THE SECRET TELEGRAPH COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $300,000 to perfect secret methods of telegraphy and devices and instruments for transmitting messages. The incorporators are: C. A. Auer of New York, N. Y.; H. Lee Sellers and R. H. Sellers both of Montclair, N. J.

Trade Notes

THE ERIE PUMP & EQUIPMENT COMPANY of Erie, Pa., has changed its name to the Northern Equipment Company.

THE CARBO STEEL POST COMPANY of Chicago, Ill., has moved its offices to 764-5 Transportation Building, Chicago.

THE COOPER HEWITT ELECTRIC COMPANY has moved its Philadelphia office from 124 South Eighth Street to the Drexel Building.

THE MAIN ELECTRIC MANUFACTURING COMPANY, Pittsburgh, Pa., has enlarged its factory for the fourth time, again more than doubling its production facilities.

FOREIGN TARIFF NOTES NO. 23 has just been issued by the Bureau of Foreign and Domestic Commerce. The bulletin covers proposed tariff changes in the different countries of the world, import and export restrictions, etc.

THE BUILDERS' IRON FOUNDRY, Providence, R. I., states that on all orders for Globe special castings received on or after June 20, 1917, the price will be list plus 40 per cent f. o. b. cars Providence, R. I., instead of list plus 30 per cent f. o. b. cars Providence as at present.

M. M. MOORE, formerly with the machine tool department of Gaston, Williams & Wigmore, Inc., New York, has severed his connection with that firm and is now associated with the sales department of John W. Thorne & Company, Inc., in its commercial offices, 165 Broadway, New York City.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has declared an extra dividend of 1 per cent on the common stock for the quarter ended June 30. The directors also declared the regular dividends of 1¾ per cent on the preferred and 2 per cent on the common stock for the same period.

JOHN C. BRIDGMAN, general manager of the Hazard Manufacturing Company, Wilkes-Barre, Pa., manufacturer of insulated wire and cable, died quite suddenly at his home on May 28. Mr. Bridgman first became connected with the Hazard company in 1888 as sales agent and later was promoted to be secretary. About twenty-two years ago he became general manager of the company, which position he retained until his death.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has discontinued the Chicago branch of its automobile equipment department with the resignation of M. W. Hanks, former local representative. This district will now be combined with and handled from Indianapolis by H. S. Johnson, with the title of Western district representative. Mr. Hanks has taken up standardization work with the Society for Automotive Engineers.

THE CONNECTICUT ELECTRIC MANUFACTURING COMPANY, Bridgeport, Conn., has advised the trade that owing to continual advances in raw material and labor it withdrew all previous prices on material of its manufacture on June 1. New quotations, effective June 1, will be furnished upon application, subject to change without further notice. All orders received on and after June 1 will be accepted at prices prevailing at time of receipt of order.

THE SPEER CARBON COMPANY announces that work has been started on the first unit of a new factory which will form a large addition to the present plant at St. Mary's, Pa. When completed, an expenditure of approximately $500,000 will have been involved, including land, buildings, machinery, etc. The first building will be devoted entirely to the manufacture of the larger-sized carbon electrodes for electric furnaces. The new factory will be equipped to turn out both round and square electrodes in all sizes from 6 in. to 24 in. in diameter.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY at its recent meeting elected the following officers: Guy E. Tripp, chairman of board; E. M. Herr, president; L. A. Osborne, Charles A. Terry, H. P. Davis, H. D. Shute, H. T. Herr, Walter Cary, vice-presidents; T. P. Gaylord, acting vice-president; James C. Bennett, comptroller and secretary; Warren H. Jones, assistant secretary; H. F. Baetz, treasurer and assistant secretary; S. H. Anderson, assistant treasurer and assistant secretary; L. W. Lyon, assistant treasurer; F. E. Craig, auditor; W. B. Covil, Jr., assistant auditor; W. J. Patterson, assistant auditor.

New England States

EVERETT, MASS. — Arrangements are being made for extension of the ornamental lighting system from the Boulevard and Broadway to Marie Avenue, a distance of more than a mile.

FALMOUTH, MASS.—The Buzzards Bay Electric Company has filed a petition with the Board of Gas and Electric Light Commissioners for authority to erect an electric transmission line between its stations in Falmouth and Chatham for the purpose of supplying electricity to substations at Hyannis, South Yarmouth, North Harwich, Chathamport and Osterville.

FOXBORO, MASS.—The Norfolk & Bristol Street Railway Company is contemplating the purchase of a condenser pump.

NORTH BROOKFIELD, MASS.—The Quaboag Rubber Company has closed a contract with the North Brookfield Electric Light & Power Company to equip its plant for electrical operation. The contract calls for an expenditure of about $30,000.

SALEM, MASS.—Bids will be received at the office of the Massachusetts Board of Education, Room 217, State House, Boston, Mass., until July 7 for removing present fixtures and installing new electrical fixtures and wiring in the State Normal School Building at Salem. Specifications may be obtained at the office of the school, Salem, or at the office of Richard D. Kimball Company, 6 Beacon Street, Boston, Mass.

SPRINGFIELD, MASS.—The sectional three-wire system for the elimination of electrolysis, installed for the lines of the Springfield Street Railway on the west side of the Connecticut River several months ago, has proved so satisfactory that the same system will be used for the city lines when the new power arrangements are completed and all energy is received from the Turners Falls Power & Electric Company.

WORCESTER, MASS.—Plans are under consideration by the New England Power Company whereby the capacity of the local substation will be increased from 11,000 kw. to 24,000 kw., at a cost of about $100,000. The plants at Pawtucket and Woonsocket will be enlarged and a new station erected at North Adams at a cost of $75,000.

NEW HAVEN, CONN.—The Housatonic Power Company has announced its intention of building a large dam, 100 ft. high, on the Housatonic River, about 1½ miles below Zoar Bridge. The proposed basin will inundate 25 miles of territory along the river and will mean wiping out parts of Southbury, Oxford, Newton and Monroe. A large part of this territory has been acquired. Electricity generated at the dam will be utilized to operate factories in the Housatonic Valley and to supply energy to a portion of the New York, New Haven & Hartford Railroad.

Middle Atlantic States

AKRON, N. Y.—The Public Service Commission has approved the franchise granted to the Genesee Light & Power Company of Batavia under which the company will supply electricity for the municipal electric-light plant in Akron.

CHATEAUGAY, N. Y.—The Public Service Commission has approved a bond issue of $3,000 of the Chasm Power Company, of which the proceeds will be used to erect an electric transmission line to the plant of the High Falls Pulp & Paper Company in Jefferson County.

DUNKIRK, N. Y.—The Niagara & Erie Power Company of Buffalo has been granted a franchise to supply electricity for lamps and motors in certain sections of Dunkirk.

EDEN, N. Y.—The Public Service Electric Company has approved franchises for the erection of an electric transmission line in the town of Eden, along the Gowanda state highway from the Hancock road to the houses of residents who are holders of the franchise. They propose to erect the line on poles of the Postal Telegraph Company and secure electricity from the Inter-Village Electric Company of Hamburg. Walter D. Henry, Henry George and others are interested in the project.

LONG ISLAND CITY, N. Y.—The Patterson-Sargent Company, 8 Jay Street, New York City, is planning to erect a power plant, 35 ft. by 50 ft., one story, in Long Island City, to supply power for its new group of factories here.

NEW YORK, N. Y.—Plans have been filed by the Merchants' Refrigerating Company, 616 Chambers Street, for the installation of a new transformer station at its plant on North Moore Street.

NEW YORK, N. Y.—Plans have been filed by the Interborough Rapid Transit Company for the erection of a power station, 30 ft. by 60 ft., one story, on West Fifty-ninth Street, to cost about $15,000.

NEW YORK, N. Y.—Plans have been filed for alterations to a three-story power house, to cost about $10,000, at the Rockefeller Institute, Avenue A, Sixty-fourth to Sixty-sixth Street. Coolidge & Shattuck are architects.

NEW YORK, N. Y.—The New York Telephone Company has awarded a contract to the E. E. Paul Company, 101 Park Avenue, for the construction of a five-story addition, 66 ft. by 84 ft., to its exchange building at 336 West 150th Street, to cost about $100,000.

STONY POINT, N. Y.—The Buttermilk Falls Electric Company of Highland Falls has petitioned the Public Service Commission for permission to construct and operate an electric-light plant in Stony Point.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of the board of managers of Letchworth Village, 7 Wall Street, New York City, until July 12 for refrigeration equipment for storehouse, bakery, refrigerating plant and cold storage building at Letchworth Village, Thiells. Drawings and specifications may be seen at office of the board of managers, 7 Wall Street, New York City; at the New York office of the Department of Architecture, Room 1224, Woolworth Building. Copies may be obtained at the Department of Architecture, Albany. Lewis F. Pilcher is state architect.

DOVER, N. J.—The New Jersey Power & Light Company is negotiating with the Hackettstown (N. J.) Electric Light Company to furnish energy to the latter company for distribution in Hackettstown and vicinity. It is proposed to erect an electric transmission line from Hackettstown to Netcong to connect with the transmission system of the New Jersey Power Company there.

MERCHANTVILLE, N. J.—The Public Service Electric Company is contemplating the installation of a street-lighting system here. An electric transmission line will be erected from its power plant in Burlington to Merchantville to furnish energy for the service.

NEWARK, N. J.—Bids will be received by the Board of Trustees of the Newark City Home until July 16 for electrical work at the home. John Waferling, 810 Broad Street, Newark, is architect; Carl Heller is secretary of board.

ROCKAWAY, N. J.—To conserve the local water supply, the borough has requested manufacturing plants utilizing this service to provide other means for operation. This will necessitate the installation of electric motors with energy supplied by the New Jersey Power & Light Company of Dover, which operates in this district. E. E. Yensel of Dover is president of the power company.

SOUTH AMBOY, N. J.—The City Council is negotiating with the Middlesex & Monmouth Electric Light, Heat & Power Company for improvements in the local street-lighting system.

BANGOR, PA.—The Pennsylvania Utilities Company has secured a contract from the North Bangor Slate Company to supply energy to operate the plant of the latter company.

BEAVER FALLS, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 20 for plumbing, gas piping, conduit and wiring and lighting fixtures in the United States post office at Beaver Falls. For details see Searchlight Section.

BETHEL, PA.—The Blue Mountain Electric, Mount Aetna, and the Marion Electric Companies in Berks County; Union Electric, Bethel Electric and Bunker Hill Electric Companies in Lebanon County have been consolidated under the name of the Blue Mountain Electric Company with headquarters at Bethel. Energy to operate the consolidated plants and lines will be obtained from the Reading (Pa.) Transit & Light Company.

CHESTER, PA.—The Seaboard Steel Casting Company, recently acquired by the American Locomotive Company, is contemplating the construction of a new power house in connection with other extensions to its works.

HARRISBURG, PA.—Plans are being considered by the Western Union Telegraph and the Postal Telegraph-Cable Company for the establishment of a joint conduit system in the business section to replace the present aerial lines.

HAZLETON, PA.—The Harwood Electric Company has entered into a contract to supply electricity to operate the works of the Girard-Mammoth Colliery at Raven Run.

MILLERSBURG, PA.—The Millersburg Electric Light, Heat & Power Company is erecting a new electric transmission line to Halifax via Juniata and Montgomery's Ferry, to furnish local electric light and power service. A new lighting system will be installed in Millersburg by Jan. 1. The erection of an electric transmission line to Liverpool, and also the acquisition of the property of the Liverpool Electric Company, is under consideration by the Millersburg company.

NORRISTOWN, PA.—Application will soon be made for charters for the following new electric companies: Washington Square Electric Light & Power Company, to operate in the township of Whitpain; the Railway Electric Light & Power Company, to furnish electrical service in Lower Gwynedd; the Gwynedd Farmers' Electric Light & Power Company, to supply electricity in Upper Gwynned Township, and the Superior Electric Light & Power Company, to furnish electrical service in Upper Dublin Township.

PHILADELPHIA, PA.—After a delay of three years the Public Service Commission has approved the proposed lease of space in the Keystone Telephone Company's conduits to the Philadelphia Electric Company.

PHILADELPHIA, PA.—The Crew Levick Company, Land Title Building, is contemplating the construction of a power station in connection with its new oil plant to be erected on Petty's Island, Delaware River.

PHILADELPHIA, PA.—The United Electric Construction Company, 1727 Sansom Street, has been awarded a contract for electrical apparatus in one of the new buildings to be erected at the League Island Navy Yard.

PHILADELPHIA, PA.—Contracts have been awarded by the Penn Chemical Works, 1332 Washington Avenue, to Nickson Duggan & Company of Philadelphia, for the erection of addition 25 ft. by 50 ft., three stories, and a power house, 40 ft. by 100 ft., to cost about $75,000.

PHILADELPHIA, PA.—Bids will be received at the office of the Department of City Transit, 754 Bourse Building, Philadelphia, until July 10 for building removal and erection Frankford Elevated Railway, including electrical installation for station buildings. Plans and specifications may be obtained at Room 758 Bourse Building upon deposit of $10 for each set of plans. William S. Twining is director.

PHILADELPHIA, PA.—Bids will be received by George E. Datesman, director of the Department of Public Works, and the board of trustees of the Free Library of Philadelphia, Room 216, City Hall, Philadelphia, until July 12 for the erection of the building for the Free Library of Philadelphia, to be located on a plot bounded by Vine, Nineteenth, Wood and Twentieth Streets, as follows: (1) For the entire work, except plumbing, heating and ventilating and electrical work ; (2) plumbing and drainage; (3) for electrical equipment work. Plans may be obtained from Horace Trumbauer, architect, 1406 Land Title Building, Philadelphia.

READING, PA.—Plans are being considered by the Metropolitan Electric Company for rebuilding its power plant at Klapperthal, which was destroyed by fire some months ago, causing a loss of about $100,000.

ANNAPOLIS, MD.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 9 for construction of a new wing and connecting building, including a conduit and wiring system, forming an extension to Isherwood Hall at the Naval Academy at Annapolis. Lighting fixtures will be furnished under another contract. Plans and specifications can be obtained upon application to the above bureau.

BALTIMORE, MD.—Plans are being prepared by the Consolidated Gas, Electric Light & Power Company for the erection of another substation, to be known as Station D, at Westport. Work will begin on the new station as soon as Station C is completed.

CUMBERLAND, MD.—Plans have been completed by S. Diescher & Sons, engineers, of Pittsburgh, Pa., for the proposed new plant of the Kelly-Springfield Tire Company of Akron, to be located on property recently acquired here. A large power station will be installed in connection with

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

the proposed works. The cost of the entire project is estimated at $2,500,000.

LYNCHBURG, VA.—Contract has been awarded by the Jobbers' Overall Company to C. W. Hancock & Son of Lynchburg for the construction of a building, 64 ft. by 246 ft., equipped with steam heat and freight elevator. The equipment will consist of 480 sewing machines driven by electric motors. The cost of the building without equipment is estimated at $70,000.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 23 for the installation of an elevator plant in connection with the extension to each of the following buildings: The United States post office and court house at East St. Louis, Ill., and Huntington, W. Va.; the United States post office and custom house at Nashville, Tenn. For details see Searchlight Section.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 9 for eight 600-hp. boilers with superheaters and stokers for the navy yard at Norfolk, Va.; six 600-hp. boilers with superheaters and stokers for the navy yard, Philadelphia, Pa.: two 600-hp. boilers with superheaters and oil-burning equipment, for the navy yard at Puget Sound, Wash.; one 400-hp. boiler with stoker and stokers for seven existing boilers for the Naval Academy, Annapolis, Md.; stokers for ten existing boilers for the navy yard, Washington, D. C.; two 350-hp. boilers with superheaters and stokers for the navy yard at Charleston, S. C., and two 600-hp. boilers with superheaters and oil-burning equipment for the naval station at Pearl Harbor, Hawaii. Drawings and specifications (No. 2441) may be obtained on application to the bureau or to the commandants of the naval stations named.

North Central States

DETROIT, MICH.—Plans have been prepared by Albert Kahn and E. Wildy, 58 West Lafayette Boulevard, architects, for the construction of a power house on Third Avenue for the Burroughs Adding Machine Company.

LANSING, MICH.—The contract for lighting the State Capitol for the next two years has been awarded to the Lansing municipal electric-light plant. The Michigan Power Company now furnishes the service.

PETERSBURG, MICH.—The Petersburg Electric Light & Power Company, recently incorporated with a capital stock of $5,000, proposes to supply electricity for lamps and motors in Petersburg. William Schroder, William McAran and G. A. Guggenbihler of Petersburg are the incorporators.

BOWLING GREEN, OHIO—The Ohio Northern Public Service Company, recently organized, has taken over the property of the Lake Erie, Bowling Green & Napoleon Railway Company, from the bondholders, who secured same from the receiver. The company has been granted a franchise to erect an electric transmission line (three phase, 60 cycles) to Portage.

CINCINNATI, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 5 for mechanical stokers, etc., for the United States custom house and post office at Cincinnati, Ohio. Specifications may be obtained at the above office or at the office of the custodian, Cincinnati.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until July 10 for condenser discharge line; ornamental standards for the ornamental lighting system; also ornamental lanterns of the ornamental lighting system, for the division of light and heat. Separate bids to be submitted on each item. Drawings and specifications may be obtained at the office of the division of light and heat, Room 204, City Hall.

COLUMBUS, OHIO.—Additions are being made to the power plant of the Columbus Railway, Power & Light Company on Spring Street. Contracts have been placed for the boilers.

COLUMBUS, OHIO—The City Council is considering the financial side of the proposal for improvements to the municipal electric-light plant recommended by Herman Gamper, city engineer. To put the plant in proper condition with the latest type of lamps installed throughout the city will cost approximately $114,000.

DAYTON, OHIO.—The construction of a new power building, 60 ft. by 180 ft., seven stories high, to cost approximately $250,000, has been announced by H. E. Talbott.

DAYTON, OHIO—The Dayton Metal Products Company, it is reported, will soon award a contract for a power plant, to cost about $250,000, adjoining its works on North Taylor Street.

DE GRAFF, OHIO.—The sale of the municipal electric plant is under consideration, for which bids are now being asked.

EAST LIVERPOOL, OHIO—Bids will be received by the director of public service of the city of East Liverpool, Ohio, until July 2 for furnishing and installing steam, exhaust, feed water and miscellaneous small piping, pipe covering for same, damper regulator and ash conveyor and other appurtenances in connection with equipment of the new pumping station for the city water-works station. Chester & Fleming, Union Bank Building, Pittsburgh, Pa., are engineers.

HAMILTON, OHIO.—A decision handed down by Judge Harlan, giving the Ohio Gas & Electric Company of Cincinnati the right to erect poles in Butler County and cross roads with its wires without obtaining permission of the county officials gives the municipal electric plant in this city a competitor for furnishing electricity for lamps and motors.

IRONTON, OHIO.—The capital stock of the Ironton Electric Company has been increased from $15,000 to $150,000.

MANSFIELD, OHIO.—The Mansfield Electric Light & Power Company is building a 12,000-kw. power plant and erecting a 44,000-volt electric transmission line to Mansfield and Ashland, Ohio. It is expected to have the plant in operation by Sept. 1, 1917. A. V. Wynne is general superintendent.

MARION, OHIO.—Extensive improvements are being made to the power plant of the Marion Railway, Light & Power Company, including the installation of a Heine steam boiler, large steam turbine, surface condenser, air pump, circulating pump, boiler-feed pump and motor-driven exciter. A new modern cooling system will replace the old pipe spray system. The cost of the system is estimated at $37,000.

MINERAL CITY, OHIO—Bids will be received by the Village Council at the office of Fred Hoover, village clerk, Mineral City, until July 9 for lighting the street of the village with electricity for a period of ten years, according to plans and specifications, and for a franchise to furnish electricity in the village for a period of 25 years.

ST. PARIS, OHIO.—The City Council has accepted the bid of the Dayton Power & Light Company for $17,000 for the municipal electric-light plant. Improvements, it is understood, will be made to the plant and street-lighting system.

SPRINGFIELD, OHIO.—The Springfield Gas & Electric Company has applied for permission to erect a 6600-volt transmission line over the tracks of the Baltimore & Ohio Southwestern Railroad at Jefferson Street and South Grand Avenue East. The proposed line will furnish electricity to the Jones & Adams coal mine.

WARRENSVILLE, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 218, City Hall, Cleveland, Ohio, until July 5 for construction of a nurses' home building, school building and three cottage ward buildings for the Tuberculosis Sanatorium at Warrensville as follows: (1) General contract; (2) heating and plumbing; (4) electrical work. Drawings and specifications may be obtained at the office of the city architect, 604 City Hall.

ZANESVILLE, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 20 for the installation of an electric freight elevator in the United States post office at Zanesville. For details see Searchlight Section.

ASHLAND, KY.—The City Council has appropriated $5,000 for the installation of a new street-lighting system in the business section of the city.

BICKNELL, IND.—The Commissioners of Knox County have granted the Indiana Power & Water Company a franchise to furnish electricity in Edwardsport, Westphalia, Freelandville and Sandborn.

PETERSBURG, IND.—The Indiana Water & Power Company of Bloomfield has taken over the Pike County electric system in Petersburg, at $48,000. A high-tension transmission line will connect Petersburg with the power plant of the company at Edwardsport.

SPRINGFIELD, ILL.—Extension of the franchise of the Springfield Gas & Electric Company as a compensation for placing all its wires in a conduit system is proposed by the Springfield Commercial Association in a communication in form of an ordinance offered the City Council. Thomas Rees is chairman of the conduit committee of the commercial association.

THOMSON, ILL.—Bids will be received at the office of Franklin J. Stransky, attorney for the Savanna and York Drainage District, Savanna, Ill., until July 6 as follows: (a) For furnishing all material, machinery and labor for the construction of a pumping station and appurtenances; (b) for furnishing and installing pumping machinery, electrical apparatus and auxiliaries. Alternate bids will be received on an oil engine or steam-driven plant. Plans and specifications may be obtained from the Edmund T. Perkins Engineering Company, First National Bank Building, Chicago, Ill., and from N. D. French, secretary, Thomson, upon deposit of $10.

MEDFORD, WIS.—The Medford Lighting & Heating Company is reported to be considering the installation of new lamps.

MOSINEE, WIS.—The Wisconsin Valley Electric Company, it is reported, is contemplating erecting an electric transmission line from Mosinee to Stevens Point.

TOMAH, WIS.—The City Council has awarded the Wisconsin-Minnesota Light & Power Company of Eau Claire a contract for lighting the streets of the city for a period of five years. The contract calls for the installation of 90 bracket lamps of 100 cp. each. The company has also submitted a proposal to supply electricity for the pumping station of the municipal water-works system.

CEYLON, MINN.—Extensions and improvements are being made to the municipal electric-light plant.

LAKEFIELD, MINN.—Bids will be received by the Village Council until July 10 for the construction of a concrete smoke stack or chimney for the municipal power plant.

MORGAN, MINN.—The Wherland Electric Company is reported to be considering extending its service to the villages of Vesta and Seaforth.

ST. CLOUD, MINN.—The ornamental lighting system will be extended from East Germain Street to the Hinckley.

ST. PAUL, MINN.—Bids will be received at the office of the Minnesota State Board of Control, State Capitol, St. Paul, for furnishing and installing complete, including glassware and lamps, fixtures in the Minnesota Historical Society Building, St. Paul. The sum of $5,000 has been appropriated for the work. Specifications may be seen at the office of the Minnesota State Board of Control, Builders' Exchanges of St. Paul, Minneapolis and Duluth.

ST. PETER, MINN.—Bids will be received by W. H. Holz, auditor of County of Nicollet, Court House, St. Peter, until July 9, for erection of addition to the Nicollet County Court House as follows: (A) For general construction and wiring; (B) heating. George Pass & Sons of Mankato are architects.

WILLMAR, MINN.—The St. Cloud (Minn.) Public Service Company is contemplating extending its electric transmission lines to the city of Willmar to furnisn electrical service.

CLERMONT, IOWA.—The Northeastern Iowa Power Company, recently incorporated by C. Miller & Sons of Clermont, who have been operating under the name of the Turkey River Power Company, it is reported, will take over the electric-light and power system that serves 18 towns. Further extensions are contemplated to the system.

ELLSWORTH, IOWA—The farmers on the Story Road from Ellsworth for a distance of 3 miles are considering making a connection with the electrical service of the city of Ellsworth.

GRANT, IOWA—The cost of installing an electric-light and power plant in Grant is estimated at $5,000.

GRINNELL, IOWA.—The Iowa Light, Heat & Power Company is contemplating extending its electric transmission lines from Grinnell to Newburgh, a distance of 7 miles.

LE MARS, IOWA.—The Iowa Light, Heat & Power Company of Grinnell, it is reported, will build a central power station in Le Mars.

PELLA, IOWA—D. S. Umbenhauer, 932 Park Street, Pella, is reported to be interested in the construction of an electric railway in connection with the Wabash Railroad.

HARRISONVILLE, MO.—At an election held recently the proposal to grant a franchise to L. K. Green & Sons of Pleasant Hill to furnish electricity for commercial purposes in Harrisonville was defeated. The City Council will soon call an election to submit to the voters the proposal to issue $25,000 in bonds to install a complete plant.

KIRKSVILLE, MO.—A committee has

been appointed by the City Commissioners to make investigations relative to the installation of a street-lighting system.

CAYUGA, N. D.—The citizens of Cayuga have voted in favor of installing an electric-lighting system.

CHURCH'S FERRY, N. D.—The installation of an electric-lighting system in Church's Ferry is reported to be under consideration.

GLEN ULLIN, N. D.—The Hannes Light & Power Company is planning an extension to its power station and the installation of engines and other equipment.

MICHIGAN, N. D.—The municipal electric-light plant and fire hall were recently destroyed by fire, causing a loss of about $9,000.

MINNEWAUKAN, N. D.—The installation of an electric-lighting system in Minnewaukan is under consideration.

BONESTEEL, S. D.—Plans are being prepared by Bruce & Standeven, engineers, Omaha, Neb., for the installation of an electric-lighting system.

COLOME, S. D.—The installation of an electric-light plant in Colome is under consideration.

ISABELLA, S. D.—The installation of an electric plant in Isabella is under consideration.

SCRIBNER, NEB.—The Council has granted the Nebraska Gas & Electric Company of Omaha a franchise to furnish electricity in Scribner.

THEDFORD, NEB.—The city of Thedford, it is reported, has awarded a contract to B. A. Kirkpatrick of Anselmo for the installation of an electric-light and power plant.

BEATTIE, KAN.—Plans have been prepared for improvements to the local electric-light plant, owned by Daniel Hockman, involving an expenditure of several thousand dollars.

KANSAS CITY, KAN.—The City Commissioners have decided to discard the arc lamps now in use and substitute incandescent lamps of 250, 400 and 600 watts.

Southern States

WILMINGTON, N. C.—Bids will be received by the Cape Fear Packing Company, Southern Building, Wilmington, until July 11 for construction of packing house as follows: (1) For a reinforced concrete and brick packing house; (2) for insulation; (3) elevators; (4) boilers; (5) engine; (6) generator and switchboard; (7) for special packing-house equipment; (8) refrigerating machinery and piping; (9) steam fitting, lard and grease lines. Plans and specifications may be seen at the office of the Cape Fear Packing Company, and may be obtained on application to Wilson & Sompayrac, Palmetto Building, Columbia, S. C., architects, or the Packers' Architectural & Engineering Company, Manhattan Building, Chicago, Ill., upon deposit of $25.

ST. HELENA ISLAND, S. C.—MacDonald, Wilkins & Company of Beaufort has awarded contract to the Georgia-Carolina Utilities Company, Whitaker and Harris Streets, Savannah, for the installation of an electric-light plant of sufficient output to maintain 400 lamps to be operated in connection with the present water system. The installation is to consist of a 240-amp.-hr. storage battery, with duplicate generating plant and heavy auxiliary fire pump for present water system and possible fire service. Post office address St. Helena, Frogmore.

KNOXVILLE, TENN.—A petition has been presented to the City Council asking for lamps in Marble City.

CORINTH, MISS.—B. F. Liddon, owner of the Corinth elevator feed mill, it is reported, contemplates the purchase of crude oil engines and other machinery.

JACKSON, MISS.—The installation of an ice and cold storage plant at Jackson, Miss., is reported to be under consideration by the Mississippi State Penitentiary Board.

ARKADELPHIA, ARK.—The management of the Arkansas Light & Power Company has announced extensive improvements at its plants throughout the State. Two electric transmission lines, one 75 miles long, are under construction. One is to connect Pine Bluff, England, Lonoke and Carlisle, the other to connect Paragould, Marmaduke, Rector, Greenway and Piggot. Work will soon begin on laying new mains here and rebuilding the local plant.

DURANT, OKLA.—The Pioneer Telephone & Telegraph Company of Oklahoma City is contemplating improvements to its local plant, to cost about $35,000, and will include the installation of a switchboard with a capacity of 4000 telephones.

DURANT, OKLA.—Contract has been awarded to J. J. Rooney of Muskogee for the construction of a power house for the Normal School, at $14,219. The Cook & McDonnell Company of Oklahoma City was awarded the contract for heating at $4,100.

PICHER, OKLA. (Not a Post Office)—The Central Ice Water Company is reported to be contemplating the purchase of pumps and power equipment, water tower, etc.

TULSA, OKLA.—The City Council is considering extensions to the fire-alarm system, including the installation of additional alarm boxes in the business and residential districts and complete equipments in West Tulsa and Kendall, at a cost of about $35,000.

FORT SAM HOUSTON, TEX.—The Council of National Defence has awarded a contract to the Stone & Webster Engineering Corporation of Boston, Mass., for the erection of about 2000 buildings at the Fort Sam Houston cantonment for the accommodation of 40,000 soldiers. The plans provide for the installation of a complete lighting system. The cost of the entire work is estimated at $3,500,000.

FREEPORT, TEX.—Surveys are being made by the Freeport Sulphur Company, which is owned by the Swenson syndicate of New York City, for the proposed interurban electric railway, to be constructed between Freeport and Houston, via Rosenberg and several other towns, covering a distance of about 100 miles. It is proposed to utilize the waste power of the large steam power plant at the sulphur mines of the company to generate electricity to operate the proposed railway. W. A. Randle, engineer of the Freeport Sulphur Company, has charge of the surveys.

STARK, TEX.—The Weir-Reynolds Lumber Company, recently organized, contemplates the construction of a lumber mill with a daily capacity of 300,000 ft. of lumber and to build an industrial city in connection with same. The proposed project will include the construction of a railroad 30 miles long, water-works, electric-light plant, ice factory, dwellings, etc. The property consists of 90,000 acres of virgin long-leaf yellow pine in Newton. R. W. Wier is president, and J. B. Reynolds secretary, both of Houston.

Pacific and Mountain States

COLVILLE, WASH.—The Stevens County Light & Power Company has petitioned the County Commissioners for a franchise to erect and operate electric transmission lines over certain roads in the county.

EVERETT, WASH.—The Commissioners of Snohomish County have granted the Everett Gas Company permission to erect and operate electric transmission lines over certain roads in the county in the vicinity of Snohomish for a period of 50 years.

OKANOGAN, WASH.—The Okanogan Power Company is planning to rebuild its local lines.

SEATTLE, WASH.—The City Council is planning to build the municipal car line to the Todd shipbuilding plant by August 15, providing that equipment can be secured.

EUGENE, ORE.—The Comet Electric Company of Eugene has been awarded the contract for electrial work in connection with the erection of the Woman's Dormitory at the University of Oregon, Eugene.

MYRTLE CREEK, ORE.—A special election will be held on June 30 for the purpose of voting upon the adoption of a new charter. This is being done primarily in order to clear the way for the construction of a municipal power, light and water plant.

BEVERLY HILLS, CAL.—The State Railroad Commission has granted the Beverly Hills Utilities Company, which furnishes electrical service in and about Beverly Hills, permission to sell its system to the Southern California Edison Company of Los Angeles, at about $23,347.

FRESNO, CAL.—The San Joaquin Light & Power Company has been awarded a contract for the erection of a 250-hp. reciprocating booster pumping station in the vicinity of Taft, Kern County. The station will be located about midway between Taft and Buena Vista Lake and will cost about $50,000.

LOS ANGELES, CAL.—Plans have been announced by the Los Angeles Investment Company for the construction of a number of colonial bungalows in Rodgers Park. A new street-lighting system is also included in the new project.

LOS ANGELES, CAL.—The Southern California Telephone Company, recently organized, has set aside $750,000 for connecting and consolidating the Pacific and Home systems in and around Los Angeles. About $250,000 will be expended for new switchboards, additions to existing switchboards and other apparatus; long-distance systems, $14,000; installing and improving private branches, $30,000, and the remainder in consolidating the Pacific and Home exchanges at various points.

OAKLAND, CAL.—Permits have been taken out by the Pacific Pipe & Tank Company for the construction of a sawmill, dry kiln, power house, etc., in Oakland, to cost about $12,000.

RICHMOND, CAL.—Steps have been taken by the lighting committee for the installation of an electrolier lighting system on McDonald Avenue, from First to Twenty-third Avenue.

RIVERSIDE, CAL.—The City Council has adopted a resolution canceling a contract awarded to a Los Angeles firm for installing electric-lighting system on Main Street. The work will be done under the supervision of the city.

RIVERSIDE, CAL.—The contract for the erection of electric transmission and telephone lines in connection with the Paradise Valley irrigation project in Butte County has been awarded to the City Electric Supply Company of Riverside.

SAN DIEGO, CAL.—Congress has appropriated the sum of $600,000 for the installation of an electric-lighting system and other improvements on a site to be used for a marine brigade post.

SAN FRANCISCO, CAL.—The construction of an additional power house about 600 ft. below the Spaulding Dam, where it is estimated that 5000 hp. can be generated under a 173-ft. head of water, is under consideration by the Pacific Gas & Electric Company.

YOSEMITE, CAL.—Word has been received that Congress has appropriated $253,000, the full amount asked by the Department of the Interior, for Yosemite National Park. This will provide sufficient funds to complete the new power plant this fall and continue the building of the new roadway connecting El Portal with the park. The power plant will have an output of 2000 kw.

BOISE, IDAHO.—Extensive improvements are contemplated to the Swan Falls plant of the Idaho Power Company during the summer, involving an expenditure of more than $500,000 and increasing the output by 8000 hp. The company will also begin work this summer on the erection of an electric transmission line into the Jarbridge district.

GRANGEVILLE, IDAHO.—Plans are being made by the Grangeville Electric Light & Power Company for the construction of a dam and flume and power plant, to cost about $75,000. The new dam will be built below the present dam, which is near Grangeville, and will develop from 1500 to 2000 hp. The new flume will be 1500 ft. in length and will replace a flume 4000 ft. long. Eugene Enloe is president.

SALT LAKE CITY, UTAH.—Work will start soon on equipping the Saltair, Garfield & Western Railroad for electrical operation.

HARLEM, MONT.—A company has been organized by local business men to establish an electric-light plant. The company will be known as the Citizens' Electric Company and will be capitalized at $25,000. R. G. Barton is president, J. M. Rantschler is secretary, and H. C. Anderson is treasurer.

OSWEGO, MONT.—The local electric-light plant is reported to have been destroyed recently by a tornado.

Miscellaneous

JUNEAU, ALASKA.—The Council has entered into a contract with the Alaska Treadwell, the Alaska United and the Alaska Mexican Gold Mining Companies for the purchase of electrical energy for the city, for a period of ten years. The contract provides that in event the city does not install an electrical distributing system, it may make arrangements with the Alaska Light & Power Company to use its distribution system, including lines.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 12 for galvanized steel, cable clips, bronze, copper, brass and copper tubing, solder link fuses, fusible plugs, etc. Blanks and information relating to this circular may be obtained from the above office or the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

14,319. ELECTRIC RIVETING APPARATUS; Frank P. Kobert, Amityville, N. Y. App. filed June 23, 1916 (reissue). Relates to apparatus for use in electric riveting.

1,230,114. ART OF ELECTRIC WELDING; Spencer C. Cary, Brooklyn, N. Y. App. filed March 31, 1917. Roller adapted to traverse the seam, and a reduction of the metal along the line of the seam or weld.

1,230,117. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Nov. 6, 1915. Provides means for facilitating the handling of connections at a telephone switchboard.

1,230,160. STARTING INTERNAL-COMBUSTION ENGINES; Otto Heins, Edgewater, N. J. App. filed Oct. 28, 1912. Utilizes the accumulated kinetic energy of rotation to assist the motor in starting the engine.

1,230,170. TELEPHONY; Morton L. Johnson, Chicago, Ill. App. filed April 5, 1913. Relates to telephone-exchange systems.

1,230,172. AUTOMATIC CIRCUIT - CONTROLLING DEVICE; James H. Kiefer, Dayton, Ohio. App. filed Aug. 24, 1911. Operates the circuit breaker automatically after a certain time interval of flow of the current.

1,230,175. ELECTRIC MECHANISM FOR STARTING AUTOMOBILES AND THE LIKE; Cyrus B. Kurtz, Grinnell, Iowa. App. filed Dec. 1, 1916. Principle of unipolar or homopolar induction. Dynamo incorporated in flywheel.

1,230,193. RAILWAY SIGNAL; Alonzo C. Mather, Chicago, Ill. App. filed April 7, 1914. Electrically operated block signals where no electrical energy is necessary excepting when a train enters the block.

1,230,213. INSULATED PIPE JOINT; Oscar H. Pieper, Rochester, N. Y. App. filed Oct. 4, 1915. Affords a tight joint for the transmission of fluids and maintains an electric circuit through the joint.

1,230,218. OUTLET BOX; Joseph G. Raquette, Cleveland, Ohio. App. filed Dec. 10, 1915. Relates to switch-box structure.

1,230,221. RHEOSTAT; Thomas Rhodus, Chicago, Ill. App. filed Oct. 2, 1916. Provides a structural formation whereby an effective contact between the annular resistance member and the circumferentially adjustable contact member is constantly and yieldingly maintained.

1,230,247. BURGLAR ALARM; Louis Weitzman, Toronto, Ontario, Canada. App. filed July 1, 1916. An alarm automatically operated to produce simultaneously an audible signal in a house and at the police station, a visual signal in the house and a photographic record of the burglar.

1,230,280. SOUND-TRANSMITTING APPARATUS; Albert E. Coy, Chicago, Ill. App. filed Sept. 14, 1914. The degree of amplitude of the vibrations of the transmitter diaphragm can be readily adjusted to attain the desired intensity, purity and distinctness in the sound transmitted.

1,230,281. SOUND-TRANSMITTING APPARATUS; Albert E. Coy, Chicago, Ill. App. filed July 8, 1916. Relates to electrical sound transmitting apparatus.

1,230,283. ELECTROMEDICAL DEVICE; Albert H. Davidson and William C. McKellar, Huntington, W. Va. App. filed March 30, 1917. Apparatus adapted for treating the human body by creating static currents.

1,230,342. ELECTRIC DISINFECTOR AND DEODORIZER; Royden Thornberg, San Francisco, Cal. App. filed Feb. 19, 1917. Substance is volatilized by means of heat generated by an electric current.

1,230,357. DEVICE FOR CONTROLLING ENERGY DELIVERED TO WELDING ELECTRODES; Harry R. Woodrow, New York, N. Y. App. filed Nov. 17, 1915. Device for measuring the amount of energy passing to welding electrodes and for automatically disconnecting said electrodes from the source of energy when a predetermined amount has passed.

1,230,372. ELECTRIC SWITCH; Augustus J. Bowie, Jr., San Francisco, Cal. App. filed Dec. 9, 1909. Provides a switch to open the circuit promptly and to destroy the resulting arc, without damage of any nature.

1,230,384. ELECTRIC TOASTER; John F. Delahant, New York, N. Y. App. filed Oct. 19, 1916. Toast becomes wholly inclosed in a casing.

1,230,390. PORTABLE BATTERY; Louis H. Flanders, Jenkintown, Pa. App. filed March 22, 1917. Provides a portable battery which can be placed in any position, even upside-down, and the plate space may be filled to increase the capacity without increasing outside dimensions.

1,230,393. SECONDARY OR STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed Feb. 11, 1915. To simplify the construction and arrangement of storage batteries.

Record of Electrical Patents

Notes on United States Patents issued on June 19, 1917

1,230,394. STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed April 24, 1916. To simplify and cheapen the construction of storage batteries of the general type used in vehicles.

1,230,407. ELECTRICAL SWITCH; Bryson D. Horton, Detroit, Mich. App. filed March 24, 1915. Switch in which the normally stationary contacts are housed within a metallic housing.

1,230,410. OPERATOR'S KEY; William Kaisling, Chicago, Ill. App. filed April 15, 1912. Provides a "listening and ringing key" with a novel arrangement of parts which enables the key to be economically manufactured while leaving it compact and simple in construction.

1,230,421. AUTOMATIC TELEPHONE - EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed June 28, 1915. Provides a circuit arrangement for insuring the proper and quick operation of the selector switches.

1,230,429. ELECTROMAGNETIC DEVICE; Joel C. R. Palmer, New Rochelle, and Frank J. Holmes, New York, N. Y. App. filed June 8, 1915. A polarized magnetic structure suitable for polarizing relays, telephone receivers and the like, and to increase the sensitiveness of such a device.

1,230,434. AUTOMATIC TIMER FOR STARTING ELEVATORS; George H. Rowe, Berwyn, Ill. App. filed Aug. 14, 1913. Provides means for automatically giving signals, both to ascend and descend, at regular, predetermined intervals.

1,230,471. POWER SYSTEM; John D. Firmin, Philadelphia, Pa. App. filed May 29, 1912. Particularly adaptable to use in motor vehicles, to provide positive starting means for the gas engine.

1,230,480. PUSH-BUTTON CONNECTION FOR SNAP SWITCHES; Monroe Guett, Hartford, Conn. App. filed Oct. 28, 1916. Provides simple means by which a push-button can be connected with a switch-operating lever.

1,230,497. IMPULSE MOTOR; Leslie R. McDonald, Montreal, Canada. App. filed Jan. 29, 1915. Adapted to the driving of advertising devices, such as movable signs and rotary or reciprocating display tables.

1,230,524. METHOD FOR SEPARATION OF FINELY DIVIDED SUBSTANCES FROM COARSE AND FOREIGN MATTERS; Botho Schwerin, Frankfort-on-the-Main, Germany. App. filed May 13, 1915. Relates to improvements in a method for separating substances in suspension.

1,230,540. IGNITION SYSTEM AND APPARATUS; Richard Varley, Englewood, N. J. App. filed Aug. 29, 1914. Electrical systems for exploding the combustible mixture in the cylinders of an engine.

1,230,541. IGNITION SYSTEM; Richard Varley, Englewood, N. J. App. filed June 16, 1916. Refers to electrical systems such as are employed to ignite the combustible charges in the cylinders of an internal-combustion engine.

1,230,544. ELECTRICAL BOND FOR RAILWAYS; Frederick W. Walker, Milwaukee, Wis. App. filed Nov. 2, 1914. Facilitates electrically bonding railway rails.

1,230,564. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 12, 1914. Means whereby a central office operator may effect the automatic connection of a busy signal to a calling subscriber's line.

1,230,565. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed April 1, 1915. Means for automatically determining the connection of a device with one end or the other of a circuit uniting two telephone stations.

1,230,566. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Oct. 29, 1915. Facilitates the re-establishment of connections between two subscribers who have been accidentally disconnected.

1,230,578. TELEPHONE SIGNALING SYSTEM; Edward E. Hinrichsen, New York, N. Y. App. filed July 19, 1915. Device gives a plurality of signals by varying the strength of current.

1,230,582. TELEPHONE-EXCHANGE SYSTEM; Lewis H. Johnson, Bloomfield, N. J. App. filed March 11, 1915. Provides improved signaling means for telephone-exchange systems.

1,230,598. THERMOMETER UNIT; Horace N. Packard, Milwaukee, Wis. App. filed Nov. 30, 1914. Particularly applicable to meters of the type known as Thomas meters.

1,230,607. PROTECTIVE APPARATUS; Theodore Schidorsky, New York, N. Y. App. filed Jan. 26, 1917. Sounds an alarm and illuminates a compartment in the event of an attempt to open a door of the same.

1,230,610. HIGH-POTENTIAL INSULATOR; Sol. S. Sonneborn, Brooklyn, N. Y. App. filed Dec. 9, 1916. Provides protective features against high-frequency, high-potential oscillations.

1,230,615. PROTECTIVE DEVICE; Charles P. Steinmetz, Schenectady, N. Y. App. filed June 19, 1913. Protects electrical apparatus, such as transformers, included in a high-voltage electrical transmission system.

1,230,619. CARBURETOR - HEATING DEVICE; Oliver P. Strickler and Burdette C. Lewis, Mason City, Iowa. App. filed Oct. 25, 1916. Provides a heating device for carburetors.

1,230,639. SEMI - AUTOMATIC TELEPHONE SYSTEM; Bernard D. Willis, Chicago, Ill. App. filed Oct. 7, 1913. Improved means for supervising in semi-automatic telephone systems to indicate to the operators when a called line is busy.

1,230,662. ELECTRIC LIGHT SOCKET; Albert H. Buckelew, New York, N. Y. App. filed March 2, 1917. Relates to electric light fixtures or sockets for incandescent lamps.

1,230,676. SOUND REPRODUCER; John J. Comer, Chicago, Ill. App. filed July 24, 1914. Electromagnetic type adapted for use in connection with telephonic or loud-speaking circuits.

1,230,680. PROTECTION OF TRANSMISSION SYSTEMS; Elmer E. F. Creighton, Schenectady, N. Y. App. filed April 29, 1909. Electric transmission systems are protected from high-potential stresses.

1,230,681. PROTECTION OF TRANSMISSION SYSTEMS; Elmer E. F. Creighton, Schenectady, N. Y. App. filed Dec. 15, 1910. Protects transmission systems against prolonged intermittent or arcing grounds.

1,230,694. TWO-WIRE TO THREE-WIRE TELEPHONE SYSTEM; Edward D. Fales, La Grange, Ill. App. filed April 16, 1910. Relates to automatic or semi-automatic telephone exchange systems.

1,230,708. VAPOR ELECTRIC APPARATUS; Peter Cooper Hewitt, Ringwood Manor, N. J. App. filed Oct. 1, 1912. Relates to rectifying apparatus which is adapted to operate with large currents of the character utilized in commercial service.

1,230,727. DINING-TABLE PLATE-HEATING APPLIANCE; Wesley W. Kuhlmann, Woodcliffe-on-the-Hudson, N. J. App. filed March 9, 1917. To be used on a dining table for the purpose of keeping the plate warm while the meal is proceeding.

1,230,728. VOLTAGE REGULATOR; Harry A. Laycock, Schenectady, N. Y. App. filed Jan. 12, 1916. A regulator which is particularly adapted for use upon a moving vehicle.

1,230,737. LIGHTING FIXTURE; Wilfrid Lumley, Conneaut, Ohio. App. filed May 5, 1913. Electrical connection between the body or junction part employed in chandeliers and other lighting fixtures.

1,230,742. CLAMP; Adnah McMurtrie, New York, N. Y. App. filed Nov. 21, 1916. Clamp for electrical conduit.

1,230,787. AUTOMOBILE ALARM; Charles E. Robison and Morris Askin, Philadelphia, Pa. App. filed Aug. 26, 1915. Designed for use upon motor vehicles to insure against theft or unauthorized use of the latter.

1,230,788. ELECTRIC HEATER FOR STEERING WHEELS; Even J. Rohne, Minneapolis, Minn. App. filed Dec. 4, 1915. Electric heater or warming device for steering wheels of automobiles.

1,230,807. TELEGRAPH SENDING AND RECORDING DEVICE; Leo C. Shearer, Latrobe, Pa. App. filed Aug. 3, 1916. Provides a mechanism for automatically making a permanent record of the messages sent out from a telegraph sending station.

1,230,810. SIGNAL; Joseph Shiflet, McKeesport, Pa. App. filed Nov. 11, 1916. Relates to a signaling apparatus upon an automobile for giving visible indications to a car in the rear as to the direction the first automobile is to take.

1,230,826. CIRCUIT-COMPLETING PLUG FOR LAMP SOCKETS; James L. Campbell, Barryton, Mich. App. filed April 5, 1916. Adapted for electric lighting systems on automobiles.

Electrical World

F. M. FEIKER, Editorial Director W. H. ONKEN, JR., Editor

New York, June 30, 1917

Vol. 69, No. 26 Pages 1243-1290

Contents

Power Requirements of Grain Elevators. By F.F. Espenschied 1246
Performance Data of Six Motor-Driven Terminal Grain Elevators at Port Arthur and Fort William, Ontario—Features of the Power Rates.

Lighting in Automobile Factories. By C. E. Clewell 1253
Relative Costs of Lighting Equipment and Factory Buildings, Losses Arising from Poor Lighting, and Examples of Good Lighting in Representative Plants.

Discussion of Insulator and Cable Problems 1256
Eleven Papers Were Presented at Special Meeting of A. I. E. E. in New York—Cables, Insulators, Mining, Water Power and Heating of Apparatus Were Subjects Considered.

Labor Economy of Industrial Trucks and Tractors ..1250
Recent Patents 1252, 1255

Editorials
Keeping Faith with the Public 1243
Technical College Graduates in War Time 1243
"Business as Usual" 1243
Earning Power of Electric Signs 1244
Insulation Characteristics of Cables 1244
Improvement of Insulators 1244
Electric Power for Grain Elevators 1245

Station and Operating Practice
Bonus System Stimulates Ohio Operating Men 1260
Water Hammer in Feed Pipe 1260
Solving Condensing Water Supply Problem 1260
Cable-Pulling Eye 1261
Prolonging the Life of Heavily Taxed Cross-Arms 1261
Outdoor Locations for Electric Meters 1262
Calculating Ratings for Elevator Motors 1262

Central Station Service
Time Necessary to Sell New Policies to Public 1263
A 3-Cent Rate to Encourage Use of Electric Appliances 1263
Superiority of Electric Power for Metal Mining 1265
Combined Block and Room Rate for Small Town 1265

News of the Industry
Associated Manufacturers' Meetings and Elections 1269
Tribute to Samuel Insull on Twenty-fifth Anniversary. 1269
A. I. E. E. Discusses Urgent Transmission and Distribution Problems 1270
Questionnaire on Fuel for National Utilities Committee. 1271
Illinois Contractors Hold State Convention 1271
Indiana Companies Join for Increase in Rates 1272
Prospects for Coal for the Electrical Industry 1272
New York Edison Plan Denied by Commission 1272
New York to Hold Its Electrical Exposition 1272

News of the Industry—Continued
Electric Rate Increase by the Toledo Company 1273
Electrical Contractors Say "Business Must Go On" 1273
Far-Reaching Work of the National Defense Council. 1273
General Electric Strike Settled 1373
New England Power Company to Spend $7,000,000 on Plant 1274
Good Convention of the Indiana Commercial Men 1274
Niagara Power Situation 1274
Middle West Utilities Results of Operations 1275

Review of Trade and Market Conditions
A Still Higher Price Is Expected in Wiring Supplies 1280
Closer Credit Co-operation Among Electrical Jobbers. 1280
The Standardization of Trade Literature Sizes 1280
Government Decides to License Exports 1281
Freight Situation Is Becoming Better 1281
Metal Markets Conditions 1281
Current Prices of Electrical Supplies 1282

Advance in Technical Theory and Practice 1266
Book Reviews 1268
Recent Court Decisions 1276
Commission Rulings 1276
Current News and Notes 1277
Associations and Societies 1278
Men of the Industry 1279
New Apparatus and Appliances 1284
Trade Publications 1286
New Incorporations 1286
Trade Notes 1286
Construction News 1287
Record of Electrical Patents 1290

Advertising Indexes—Alphabetical, 90; Classified, 87-89. Searchlight Section, 38-50.

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They All Endorse It

Have you a Westinghouse Splash-Proof Motor on your machine?
It was designed for this service after a careful study of the requirements.
Westinghouse Engineers make a special application for each type of machine.

What does Splash-Proof mean?
1. Protected from water, yet thoroughly ventilated.
2. Powerful starting effort and overload capacity.
3. Extra large shaft, bearings and ample lubrication system.
4. Light, compact, strong and cool running.

Write for Small Motor Catalogue Number 38.

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East Pittsburgh, Pa.

Westinghouse
Underfeed Stoker

This list of Westinghouse Underfeed Stokers installed and on order was prepared to show their wide distribution throughout the United States:

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Consumers Power Co. St. Paul, Minn.	4	2000
Norfolk & Western R.R. Co., Bluestone, W. Va.	10	6670
Norfolk & Western (Repeat Order)	2	1334
Public Service Electric Co., Jersey City, N. J.	5	3000
Public Service (Repeat Order)	5	3250
United Gas & Elec. Engr. Corp., New Orleans, La.	1	900
United Gas (Repeat Order)	2	1800
United Gas (Repeat Order)	5	4500
Minneapolis General Electric Co. (H. M. Byllesby & Co.), Minneapolis, Minn.	12	7200
Minneapolis General (Repeat Order)	5	6310
American Gas & Electric Co., Windsor, W. Va.	5	6310
American Gas (Repeat Order)	3	3786
American Gas (Repeat Order)	4	5048
American Gas (Repeat Order)	4	5048
Western Lt. & Power Co., Lafayette, Colo.	1	411
Western Lt. (Repeat Order), Cheyenne, Wyo.	2	911
Western Lt. (Repeat Order), Lafayette, Colo.	4	1644
Transit Supply Co., Minneapolis, Minn.	1	550
Transit Supply (Repeat Order)	11	6050
Interstate Light & Power Co. (H. M. Byllesby & Co.), Galena, Ill.	2	820
Interstate Light (Repeat Order)	4	1640
Interstate Light (Repeat Order)	2	820
Arkansas Valley Ry. Lt. & Pr. Co. (H. M. Byllesby & Co.), Canon City, Colo.	3	1800
Union Elec. Lt. & Pr. Co., St. Louis, Mo.	10	5580
Union Elec. (Repeat Order)	6	3348
Alabama Power Co., Birmingham, Ala.	5	6000
Edison Electric Illum. Co., Boston, Mass.	8	4096
Edison Electric (Repeat Order)	6	3348
Union Gas & Elec. Co., Cincinnati, O.	8	10096
Duluth & Iron Range R. R. Co., Two Harbors, Minn.	4	1000

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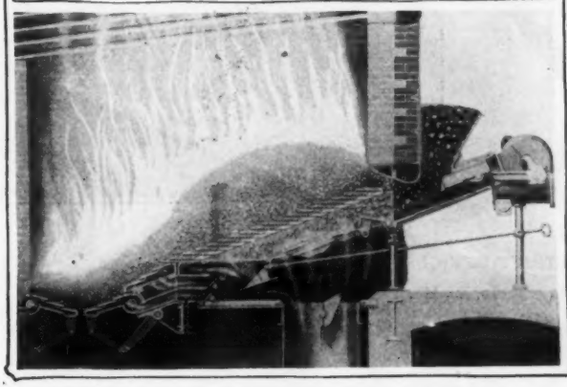
East Pittsburgh, Pa.



Wonderful Reserve Power

—NO waste—NO idle equipment —NO banked fires—NO spare boilers to be held in readiness for the daily peaks. For the Westinghouse Underfeed Stoker embodies IN ITS DESIGN a wonderful flexibility—a gigantic overload capacity.

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The Choice of a Stoker Always Narrows Down to a Study of Plant Requirements.

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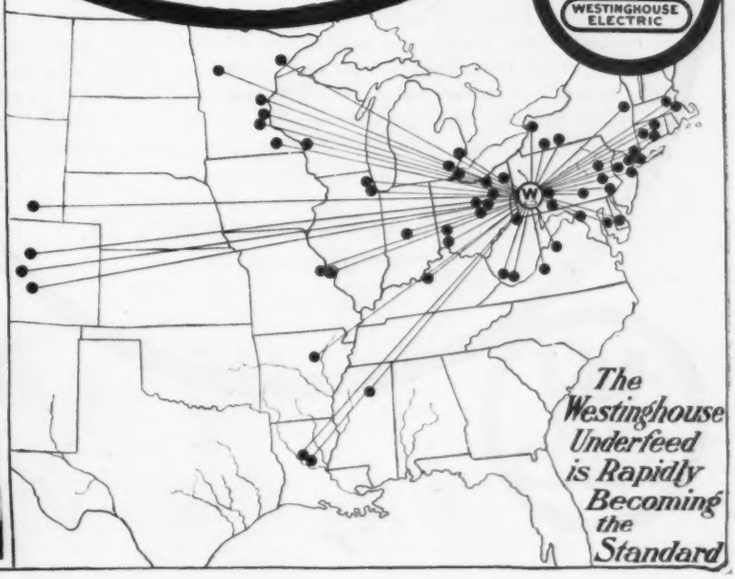
WESTINGHOUSE ELECTRIC



The Westinghouse Underfeed is Rapidly Becoming the Standard

Westinghouse

Switchboards and Switch Gear

Buffalo General Electric Co.'s New, River Steam Station

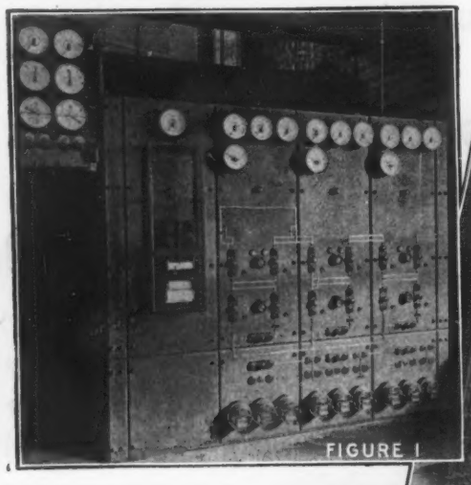


FIGURE 1

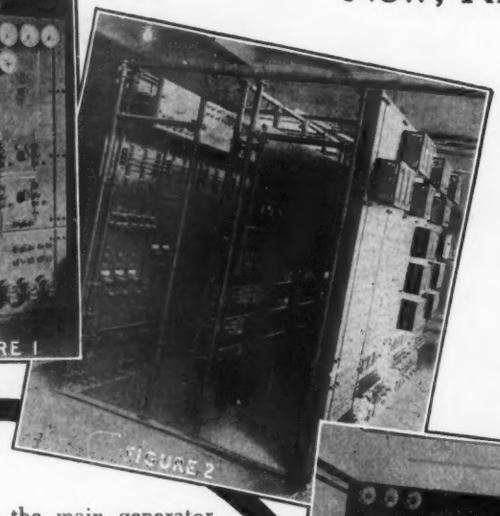


FIGURE 2

66,666 Kva. (Initial)

233,000 Kva. (Ultimate)

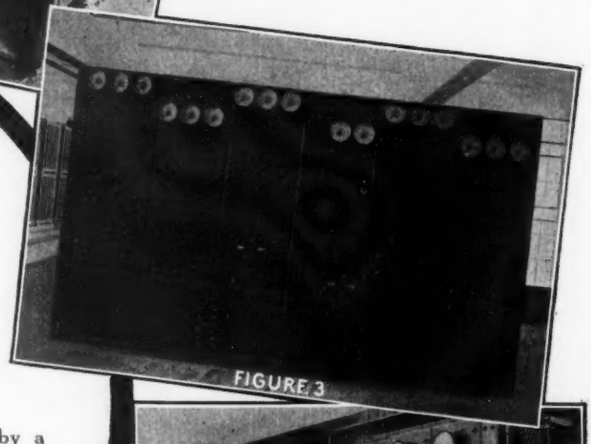


FIGURE 3

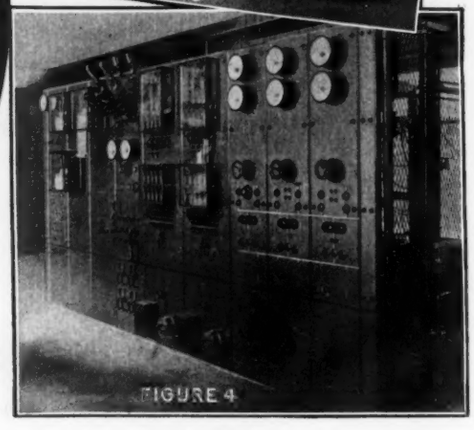


FIGURE 4

Figure 1 illustrates the main generator control board; Figure 2 its relay and watthour meter panels to rear; Figure 3 the alternating current feeder board; and Figure 4 the exciter, voltage regulator and direct-current local service board.

With these, for initial 66,666 kva. generating capacity, as part of the main switch gear (all Westinghouse) for this immense station, were included twelve 2,000 ampere Type 0-2, and seventeen 600 amperes Type 0-1 Oil Circuit Breakers.

The satisfaction given by this Westinghouse Switchboard Equipment, to both customer and consulting engineers (Stone & Webster Engineering Corporation), is evidenced by a contract just placed for additional Westinghouse Switchboard Equipment to control a new and additional 38,000 kva. generator. Included are three 3,000 ampere, Type 0-2, and six 600 ampere, Type 0-1 Oil Circuit Breakers.

This is further evidence of Westinghouse Switchboard Quality.

Westinghouse Electric & Mfg. Co.

East Pittsburgh, Pa.

Sales Offices in All Large American Cities

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W WESTINGHOUSE ELECTRIC

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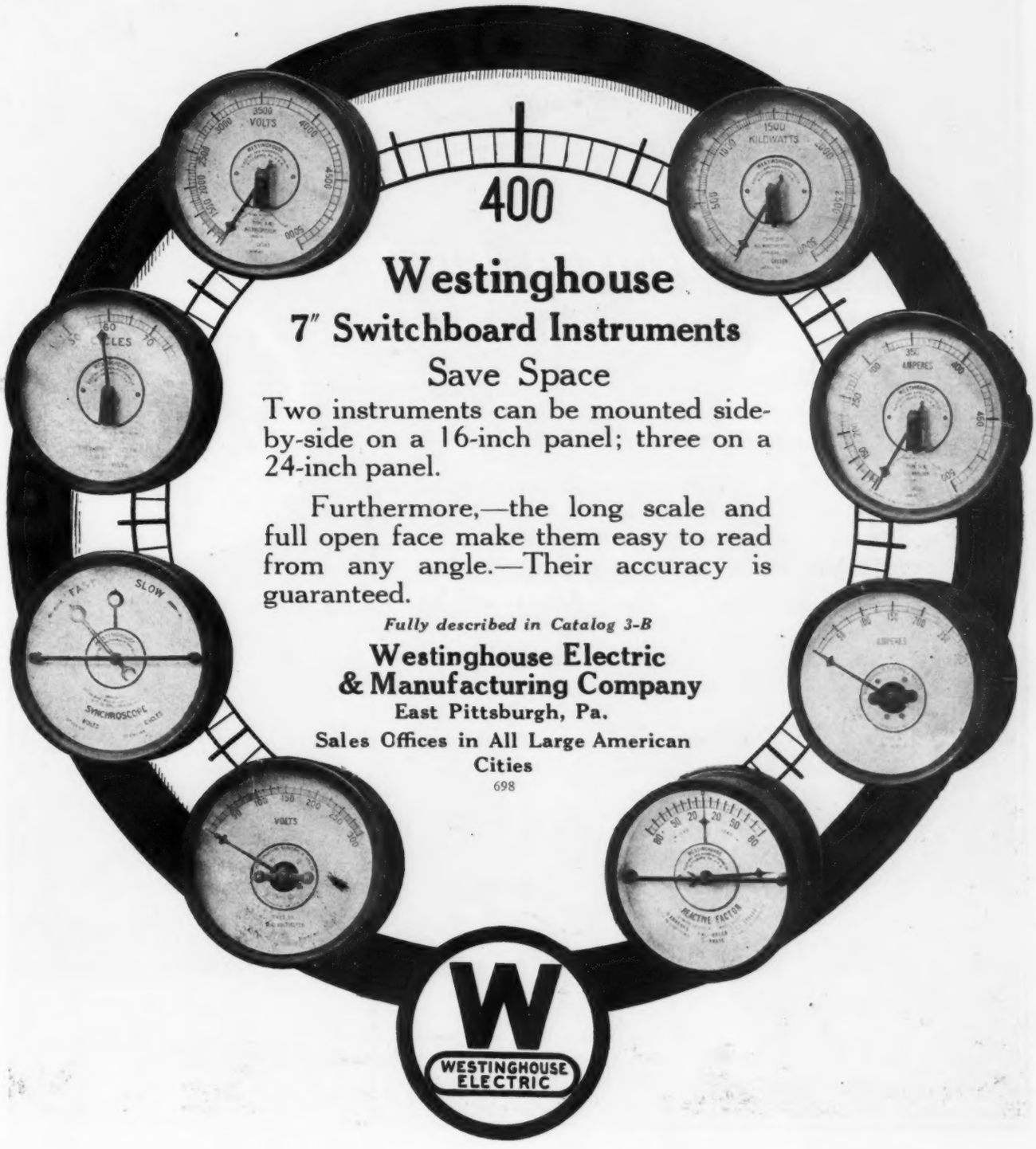
Westinghouse
Switchboard Instruments



Westinghouse
7″ Switchboard Instruments
Save Space

Two instruments can be mounted side-by-side on a 16-inch panel; three on a 24-inch panel.

Furthermore,—the long scale and full open face make them easy to read from any angle.—Their accuracy is guaranteed.

Fully described in Catalog 3-B

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Sales Offices in All Large American Cities

698

LET THE STATUES BE SEEN AT NIGHT

General Grant Statue
Lincoln Park
Chicago

WITH

Western Electric

DAVIS

FLOOD LAMPS

Portable Type

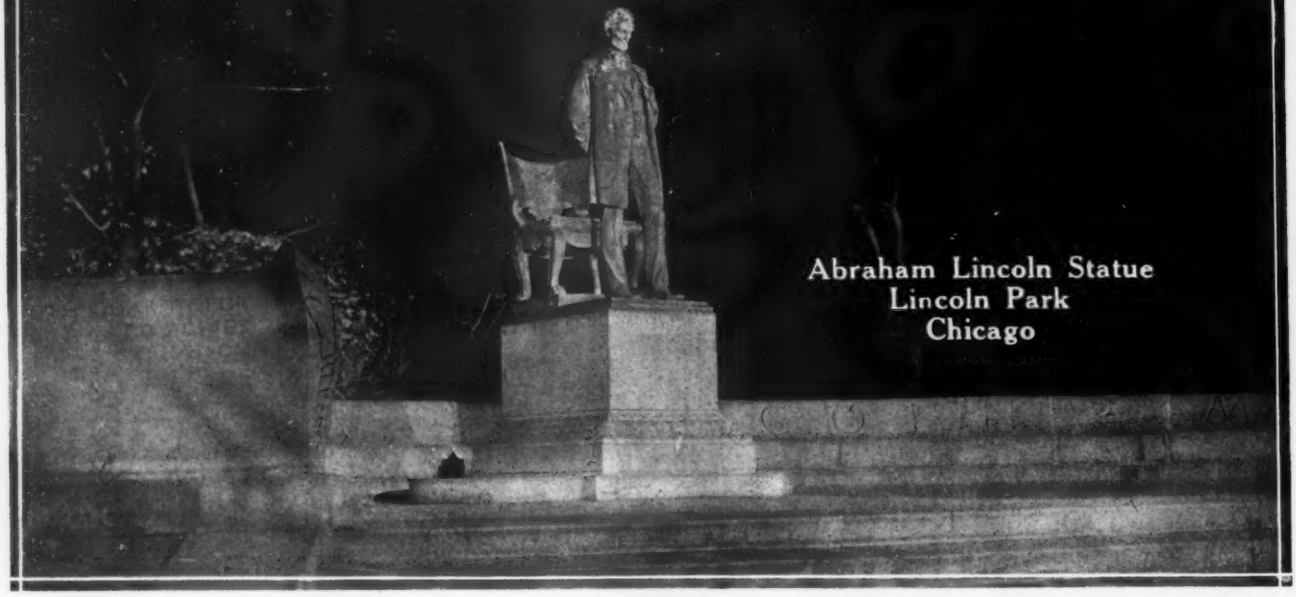
One of the many uses of these "electric daylight" producers is seen here---for patriotic and decorative purposes. In the industrial world they are used everywhere for protecting property and speeding up production at night.

Write for illustrated booklet

Bracket Type

Western Electric Company
INCORPORATED

Offices in all principal cities



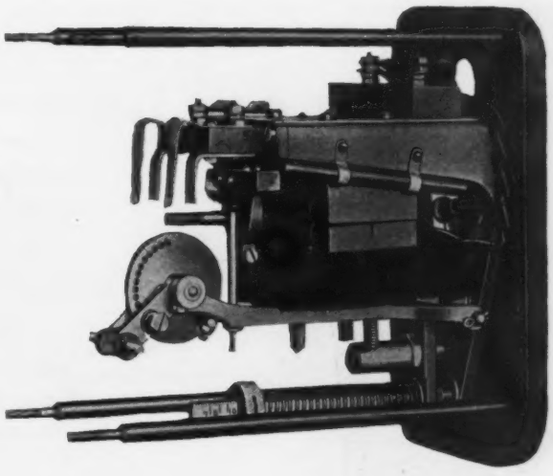
Abraham Lincoln Statue
Lincoln Park
Chicago

The runner that beats the gun is penalized

A runner that "beats the gun" in a sprint race is penalized by being set back one yard. If he beats it a second time he is handicapped another yard. If he beats it a third time he is disqualified and put out of the race.

Time Limit Relays that "Creep" are like runners that beat the gun. Costly interruptions of service are the penalties that users of such relays must pay. Sound judgment and real economy dictate the use of CONDIT Type "A" Relays—they can't creep.

CONDIT Type "A" Relays *Can't Creep*



The contact members controlled by the moving element cannot creep nearer and nearer the tripping contacts (like the sprinter stealing a stride) with every surge of current that approaches the current value at which the relay is set to operate.

No, the moving element of the CONDIT *Type "A" Relay* moves *only* when the *danger* surge comes—is *instantly reset* when the overload fails to hold beyond the limit of safety—and not only exhibits a *constant operating time factor,* no matter in how quick succession the overloads or short-circuits pass through the relay, but *also* retains this constancy of operation *without resetting* even when operation of the relay has not taken place for a long interval.

Write for full details—*Bulletin No.* 407.

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Northern Electric Company LIMITED

Sole Distributor for the Dominion of Canada, Montreal, Halifax, Ottawa, Toronto, Winnipeg, Regina, Calgary, Vancouver.

LIGHT INCREASES
THIS MAN'S EFFICIENCY

The Problem

American Industries are Mobilizing

The demand for manufactured goods, already abnormal, is bound to become even more acute. The coming months will see factories, mills and shops straining at topmost speed to serve the needs of two continents.

This crisis not only calls for extra shifts and full 24-hour operation, but also for greater efficiency. Every means must be investigated and every method studied to reduce waste and lost motion. Workmen and machines must be given a chance to do their part.

Good artificial lighting is the first essential to after-dark efficiency. It is needed tonight in thousands of underlighted industrial plants so that full capacity may be maintained from sunset to sunrise, so that sentries on guard may see.

NATIONAL LAMP WORKS
OF GENERAL ELECTRIC CO.
NELA PARK CLEVELAND

BRYAN-MARS MAZDA · MAZDA · MAZDA · STERLING MAZDA · Brilliant MAZDA · PEERLESS MAZDA · THE Fostoria MAZDA · MONARCH MAZDA · Munder MAZDA · NELA

How to Solve it

With NATIONAL MAZDA lamps you have the means for ample, economical light to increase production and to protect property. These lamps, together with your lighting experience, will solve the illuminating problems of the manufacturers in your community.

But you must assume the initiative. The manufacturer who wants better light has not had your opportunity of knowing how the best lighting results can be had. Take the message to him. It will be the connecting link between his needs and your service.

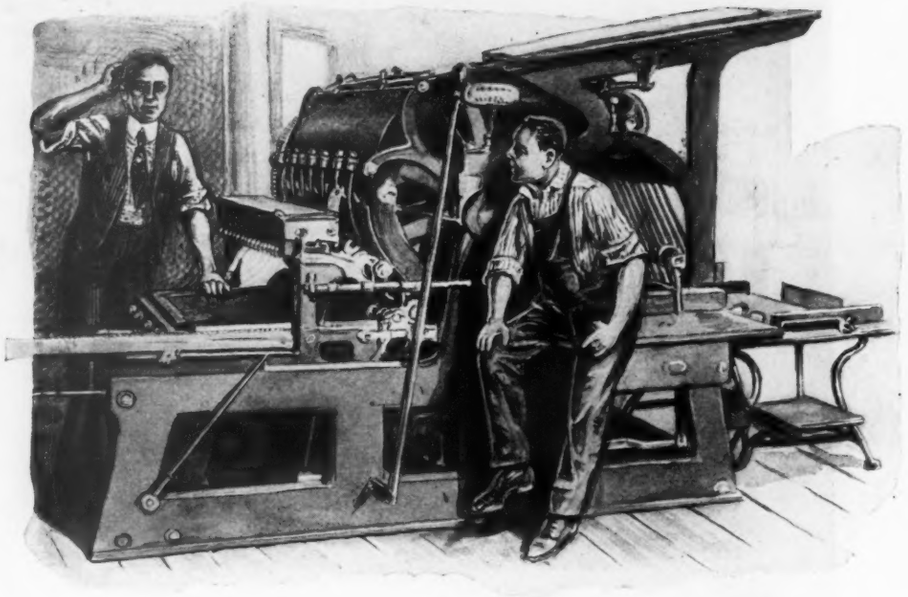
Write for our two bulletins. One deals with the use of light for protection—the other for industrial lighting. Both may be had free through the Sales Division that furnishes you NATIONAL MAZDAS.

NATIONAL LAMP WORKS
OF GENERAL ELECTRIC CO.
NELA PARK CLEVELAND

STAR MAZDA · FEDERAL MAZDA · MYLO MAZDA · Ajax MAZDA · Packard MAZDA · SHELBY MAZDA · Colonial MAZDA · G-M MAZDA · BANNER MAZDA · COLUMBIA MAZDA

LIGHT SIMPLIFIES
THIS MAN'S WORK

Can You Afford to RISK This Loss of Production ?



Can you spare your best skilled labor to take care of fuses?

Can you afford to spare from production the men in your plant who will really take care of them right?

Pressure of forced production, together with the mixed quality of labor upon which many big plants are obliged to depend, too often tends to negligence and incompetence in the performance of details of plant maintenance with any equipment.

Here is an incident that points a moral.

A large printing plant was under the impression that it could save money by using the refillable type of fuse.

As long as they were able to leave the care of fuses in the hands of skillful and careful men they had no particular difficulty.

But as business increased the pressure of its demands caused the work of caring for the fuses to gradually fall into incompetent hands.

With the result that they had so much trouble with delays due to burnouts of electrical equipment, that the plant has now returned to the use of standard enclosed fuses approved by the underwriters, and has standardized on D & W Fuses throughout its plant.

D & W FUSE CO., PROVIDENCE, R. I.

The Pioneer Manufacturer of Enclosed Fuses

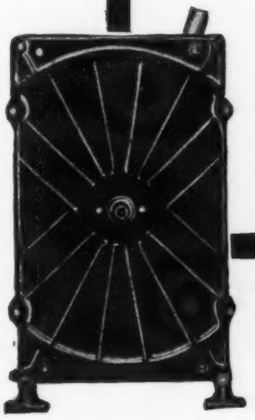
Representatives:

A. Hall Berry, New York
Pettingell-Andrews Co., Boston
Western Electric Co., All Branches
Central Electric Co., Chicago

WHY DON'T YOU get a UNIVERSAL Rheostat?

It will answer any and every storage battery charging requirement you have or will meet.

For example our UR 120 for 120 volt D.C. supply will permit you to charge any number of lead cells from 1 to 44 in series and any number of Edison cells from 1 to 60 in series at any charging rate from 20 amps maximum to 2 amps minimum.



List Price $25.00

Six hundred now going through the shop for the leading battery manufacturers and the U. S. Government. Why don't YOU collect on their experience?

Ward Leonard Electric Co.

Mt. Vernon, N. Y.

BADT WESTBURG ELECTRIC CO., Chicago, Ill.
WM. MILLER TOMPKINS, Philadelphia, Pa.
JOHN B. SEBRING, Pittsburgh, Pa.
MORSE ENGINEERING CO., St. Louis, Mo.

Why not use

BLACK VARNISHED CAMBRIC

If you are making a product requiring high insulation and long life—BLACK varnished cambric is your proper material.

Its insulation is **higher** than yellow—the cost **lower**—the life **longer.**

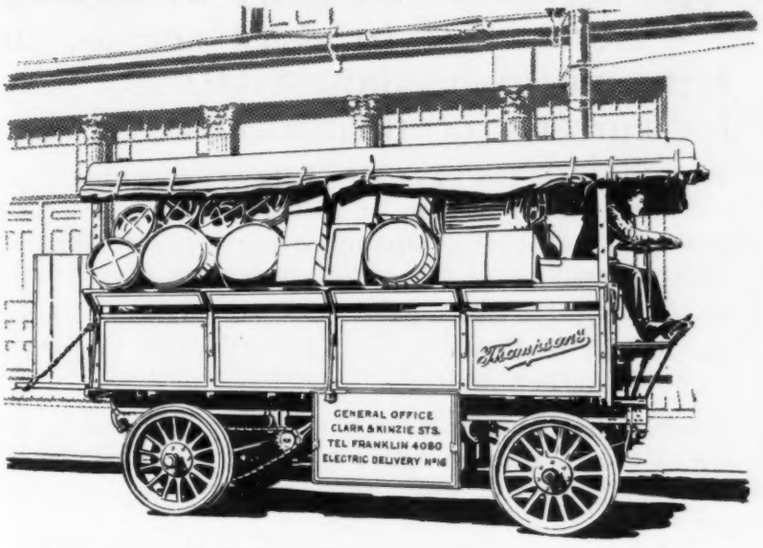
That is why the leading electrical manufacturers and electric cable manufacturers have been using our Black Varnished Cambric during the past 10 years.

We make both yellow and black varnished cambric in all commercial sizes.

IRVINGTON VARNISH & INSULATOR CO.

Irvington, New Jersey.

ESTABLISHED 1905



This 2-ton G. V. makes 50 miles per day, rain or shine. Thompson, the restaurateur, has sold all horses and operates 16 G. V. Electrics exclusively.

Four different chains of restaurants swear by

G. V. Electric Trucks

Thompson, Weeghman, Childs, Gridley—household words in Chicago, New York and Boston. Twenty-two G. V. Electrics operated by three restaurateurs.

Thompson's G. V. fleet has kept pace with the growth of his business. He has sold all horses and operates an all-electric delivery service.

Name almost any line of business and we will show you a G. V. distribution of from ten to ten hundred (1000) Electrics.

The man with an electric truck fleet will shortly be envied, not only for the money he is saving, but also *for the peculiar war-time advantages of the Electric.*

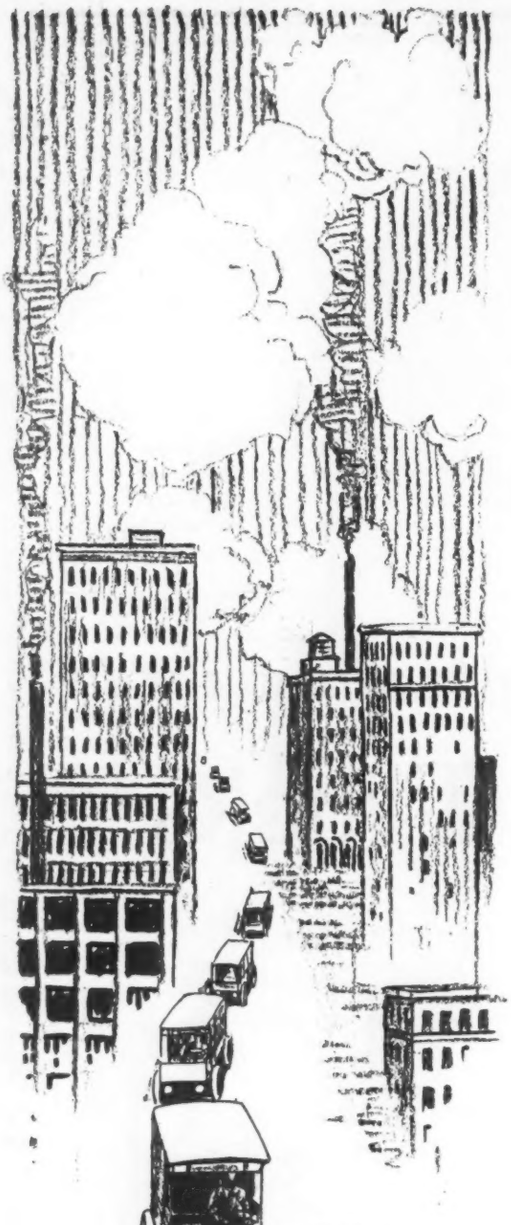
Why not write for Catalogue 82?

GENERAL VEHICLE COMPANY, INC.

General Office and Factory:

LONG ISLAND CITY, NEW YORK

NEW YORK CHICAGO BOSTON PHILADELPHIA



AN express company operating from coast to coast spends, in four cities alone, about $100,000 a year for current for their electric trucks.

They have 227 trucks in use in these four cities, representing an investment of $829,245. Other express and transportation companies are extensive users of electric trucks and are large consumers of current.

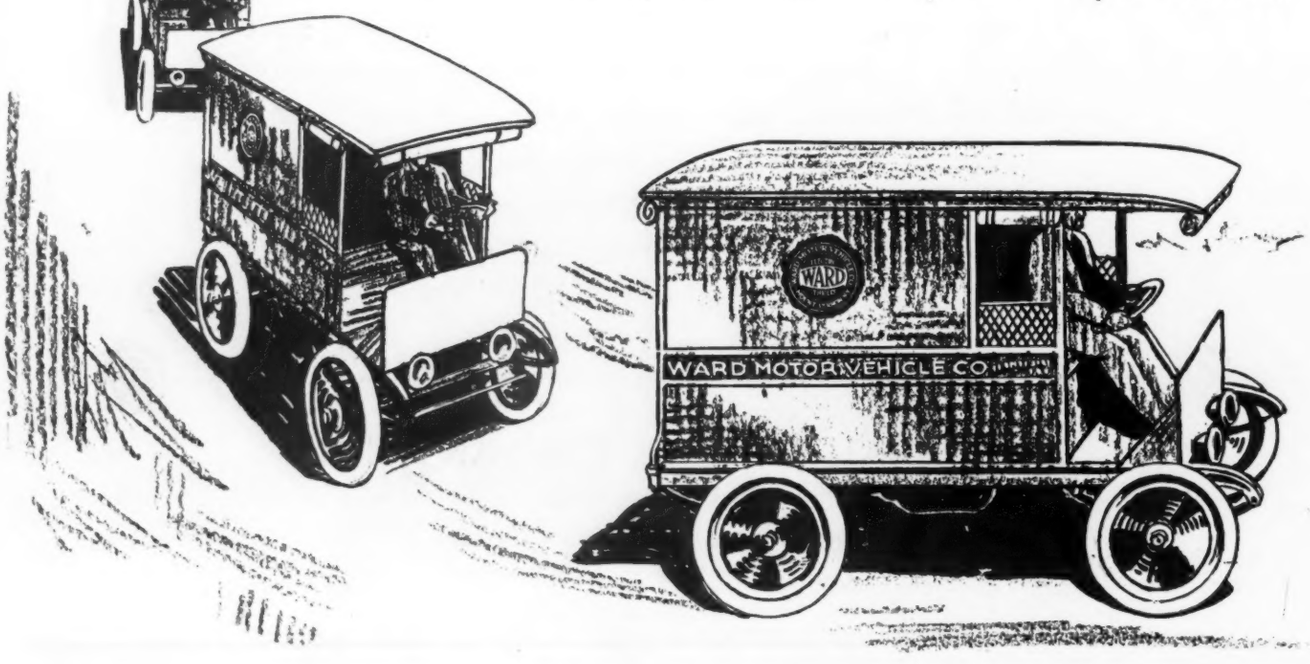
And the express company is but one of many to whom the electric truck has proved an important factor of economy in their deliveries.

A large department store has 192 electric trucks in use; a central station 120; a baker 155; a transportation company 132; and there are many others who are operating a hundred or more.

This shows how extensively the electric truck is being used by big business establishments. Concerns of this magnitude, having accurate cost systems, are in position to know exactly what type of vehicle is most economical. The evidence certainly favors the electric.

Reports gathered from hundreds of other retailers, wholesalers, express companies and all those whose deliveries are made up of short hauls and frequent stops, are so overwhelmingly in favor of electric trucks that no business man—including the central station manager—can afford to ignore them.

To what extent are you, as a central station manager, encouraging the sale of electric vehicles in your town? You take considerable pains, as you should, to promote the sale of electric appliances which use but a few cents' worth of current a month. But, do you make an equal effort to promote the sale of electric trucks, each of which will produce for you a revenue



of $100 to $300 a year? And this revenue is earned during the dullest hours of the twenty-four—between midnight and dawn.

Electric vehicle recharging is a class of business that is worth considerable effort on the part of the central station manager to develop. It is as important as any other branch of his business—as easy to get, and just as profitable to handle.

Conditions brought about by the war are all in favor of the electric truck. The increased cost of horses, feed and gasoline show up the economic value of the electric more strongly than ever. Consequently, the present is an opportune time to promote truck sales.

Electric current is one of the few things inversely affected by supply and demand. There is no limit to the supply, and the greater the demand the lower the price can be made. That argument has considerable weight with the business man who is up against the increasingly high cost of doing business.

There are many points in favor of a more extended use of electric trucks, and every central station manager and employee owes it to his own interests to make a thorough study of its merits.

It will take but a little time and no trouble to make this investigation. A letter or card addressed to the electric vehicle department of the N. E. L. A., 29 West 39th Street, New York City, or to us, will bring to you by return mail a fund of interesting and instructive data.

WARD MOTOR VEHICLE CO. ELECTRIC WARD VEHICLES MOUNT VERNON N.Y.

Ward Motor Vehicle Company

Makers of Electric Trucks of 750 lbs. to 5 tons Capacity

Mount Vernon, N. Y.

HERE ARE TWO BOOKS

EVERY CENTRAL STATION MAN SHOULD READ

These two books illustrate the tremendous field for the sale of power for electric vehicles and trucks that lies dormant, or nearly so, in practically every central station district in this country.

In a few instances these fields have been developed. The examples of the Bush Terminal load of 12,000,000 K.W. Hr. annually; the Memphis load of 600,000 K.W. Hr. annually; and the Hartford load of 733,326 K.W. Hr. annually show what can be done in the sale of energy for storage-battery-propelled vehicles. This is the best possible kind of a load, as it is *off-peak, long hour* and *profitable.*

The business that will make loads like these is found in every community. The market is at your hand—it is an opportunity that is wonderful in its possibilities.

The development of this business is a matter of co-operation, of working together in harmony of central station man, the vehicle manufacturer, and storage battery manufacturer. We are willing and anxious to do our part to develop this important field of central station service and bring it to its proper place in the broad field of electrical development.

Ask for Bulletins 500W and 600W and say "Let us co-operate in developing electric vehicle and truck loads."

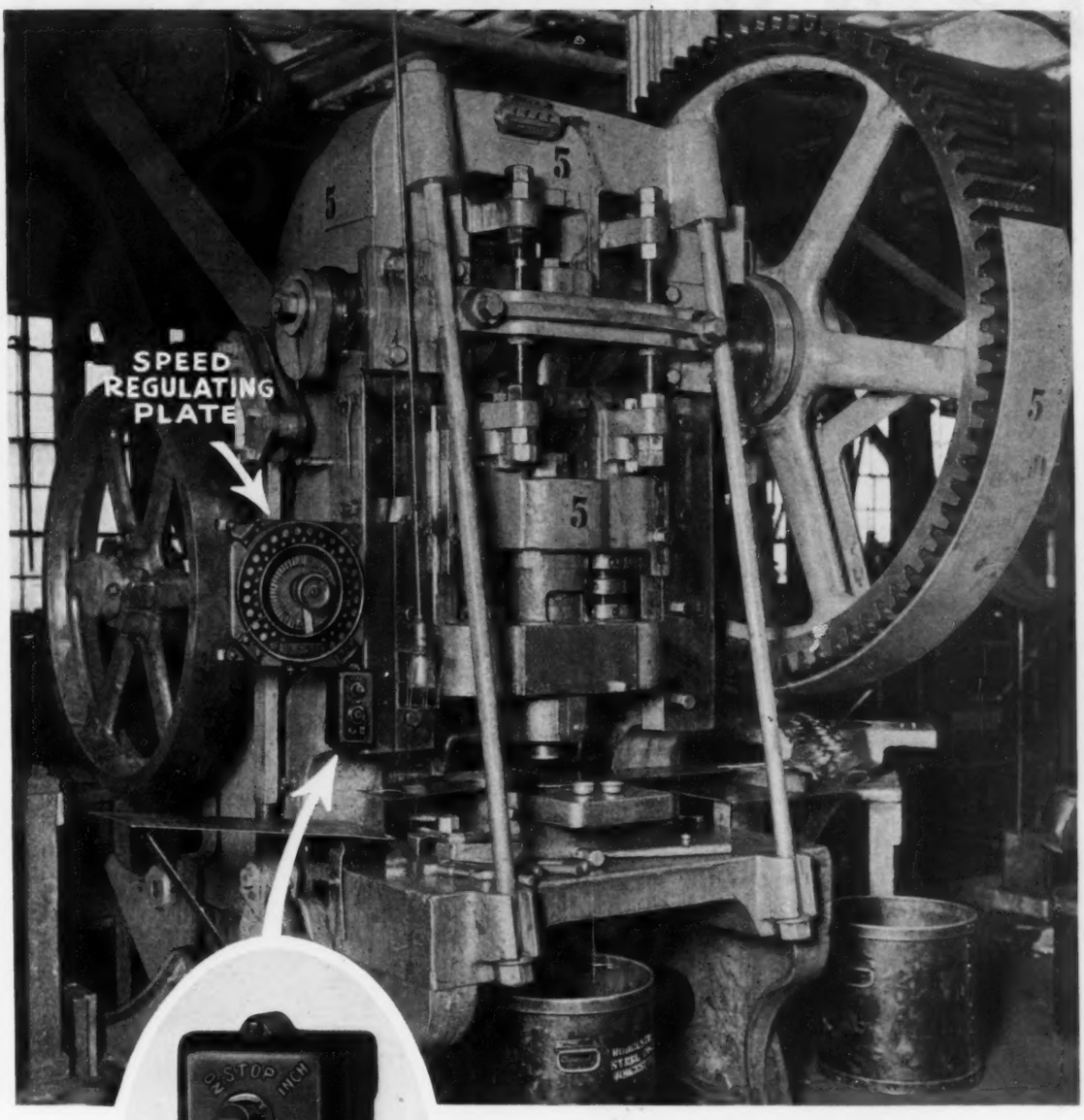
EDISON STORAGE BATTERY COMPANY

Factory and Main Office: ORANGE, N. J.

Distributors in

New York Boston Chicago Detroit San Francisco Seattle New Orleans

CH CUTLER-HAMMER CH



One of Fifteen C-H AUTOMATIC CONTROLLERS in Pressed Steel Plant

Write to office nearest you—note address below.

C-H Bulletin 6320 Automatic Controller Installation with Push Button Control.

THE CUTLER-HAMMER MFG. CO., Milwaukee

DISTRICT OFFICES

New York: Hudson Terminal (50 Church St.)

Chicago: Peoples Gas Bldg.
Boston: 77 Franklin St.
Cleveland: Guardian Bldg.
Pittsburgh: Farmers' Bank Bldg.
Philadelphia: Commonwealth Bldg.
Cincinnati: Gwynne Bldg.

Pacific Coast Agents: H. B. Squires Co.
583 Howard St., San Francisco
San Fernando Bldg., Los Angeles
309 First Ave. So., Seattle

CH CH

ORANGEBURG FIBRE CONDUIT

Study this "Close Up"

view of ORANGEBURG *Fibre Conduit* being installed. Notice the narrowness of the trench—yet eight liberally large ducts easily lay perfectly aligned within it. Notice how round and true every duct is—how smooth appearing the interior as exposed at the ends. "Pulling in" is an easy job with ORANGEBURG *Fibre Conduit*. Get Book E.

THE FIBRE CONDUIT COMPANY
ORANGEBURG, N. Y.

New York Boston Chicago San Francisco

REDUCE THE DANGER OF LIVE WIRES

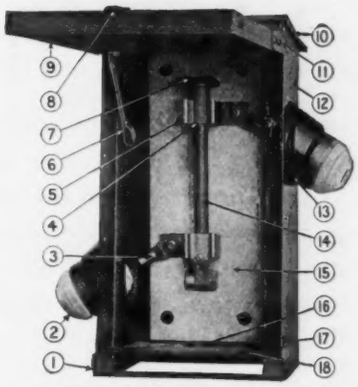
Live Wire and a Duty

The fatal accident on Summit Avenue last night calls attention to the duty devolving upon every citizen to at once report to the Electric Light Company any wire of the kind hanging loose. The wire may not belong to the company. It may be a telegraph or a telephone wire, or any other kind of a wire except an illuminating wire, but a telephone message to the Lighting Company will bring the company's repair men to the scene at once and danger to life will be averted. The company maintains an efficient repair service, but it is not omniscient and cannot know where breaks are unless told.

Citizens seeing a wire hanging loose should not attempt to ascertain if it is "live" or not. Take no chances. Notify the company at once. To do so is not to render a service to the company; it is to render a service to humanity by saving human life and preventing human suffering.

It is said that the wire that killed John De Margo last night had trailed in the street all day yesterday, harmless until the illuminating current was turned on in the evening. Had some one notified the company as soon as the wire was observed, John De Margo would be alive now.

Matthews Fuswitches are designed to open the circuit in trouble by the melting of the fuse from overload when the wires become short circuited, crossed or grounded. This results in the killing of the section in trouble. The customers on the section affected are sure to call up and report "Lights Out." A reference to your service map shows the location of the switch affected and in a few minutes your trouble men are on the job. They have instructions to remove the Fuswitch and blade and put it in their pocket before starting to clear the trouble. This absolutely prevents the possibility of some other gang re-fusing the switch while they are working on the affected line. Thus you will see that your repair men can work on a cold, dead line, without affecting the balance of your distribution system. They don't have to get out a lot of rubber blankets and other protective apparatus. Their repairs are made and the line in operation in a few minutes instead of a matter of hours.



For 6600 Volts and less
For 100 Amperes and less

POINT TWO

The BF patented Switch Blade and Cartridge eliminates the old maple carrier and the old fuse cartridge—Combines them in one.

The insulated tube is made from a redmanol base, and not only has high dielectric value but also strength and freedom from moisture troubles.

The contacts are flat. No heating possibilities.

Can't close box unless perfect contact is made.

It's right.

The above statements appeared in our "Electrical World" advertisement of Nov. 1, 1913, and referred to the Types A, B and F Matthews Fuswitches. They are even more true of the Type BF Matthews Fuswitch, which combines all of them in one at a very much lower cost to you.

Let us ship some on 30 days' trial. If satisfactory pay for them. Otherwise return freight charges collect. If your first trial order calls for 12 or more, the freight will be prepaid.

You can't lose. How many?

W. N. MATTHEWS, PRESIDENT AND TREASURER
MARTIN J. WOLF, VICE-PRESIDENT
CLAUDE L. MATTHEWS, VICE-PRESIDENT AND SECRETARY

W. N. MATTHEWS & BROTHER

INCORPORATED
MANUFACTURERS OF PATENTED ELECTRICAL SPECIALTIES
ST. LOUIS, U. S. A.

DISTRICT OFFICES
NEW YORK
CHICAGO
DENVER
EL PASO
SALT LAKE CITY
SAN FRANCISCO

FACTORIES
ST. LOUIS, MO.
ROCKFORD, ILL.
MIDDLETOWN, O.
DAYTON, O.
INDIANAPOLIS, IND.

CANADIAN DISTRIBUTERS
THE NORTHERN ELECTRIC COMPANY, LIMITED
MONTREAL, HALIFAX, TORONTO, WINNIPEG, CALGARY, REGINA, VANCOUVER, VICTORIA

DISTRIBUTERS FOR GREAT BRITAIN
S. H. MORDEN & CO. LTD., MORDEN HOUSE, DARTMOUTH STREET, WESTMINSTER, LONDON, S. W.

CABLE ADDRESS: "MATTANBRO" ST. LOUIS

DISTRIBUTERS FOR AUSTRALIA AND NEW ZEALAND
WESTERN ELECTRIC CO. (AUSTRALIA) LTD., SYDNEY, N. S. W.

CODES: A. B. C. & LIEBER'S

AT WORK FOR THE FLAG

That is the headline of the Economy Fuse ad in June 23 issue of the Saturday Evening Post. You've read it, no doubt; if you missed it, make it a point to read the advertisement. Then consider for a moment why Economy renewable Fuses are the only cartridge fuses ever advertised in national mediums. The reason is obvious—they are the only fuses made combining the advantages of the best "one time" fuses with a renewable feature that causes a saving of 80% of annual fuse maintenance cost.

Use Economy Fuses and recommend them to your customers. They are used in immense quantities by the U. S. Government, by arms and munitions plants, by powder mills, by great steel mills and other industrial establishments, and all the way down to small shops and houses.

Free Samples for tests. State types and capacities desired. Ask for catalog 19

Economy Fuse & Mfg. Co.
Kinzie and Orleans Sts. Chicago

Western Red Cedar Poles

Used in This Great Electrification Project

The electrification of the mountain divisions of the Chicago, Milwaukee & St. Paul Railway is one of the greatest projects in the history of the electrical industry. It has established a notable record in thorough and efficient construction at a low cost.

Western Red Cedar Poles were used in the electrification of the first units. It is announced that the Company is going ahead with the electrification of another unit of 220 miles from Othello, Wash., to Seattle, Wash., **and are using Western Red Cedar Poles.**

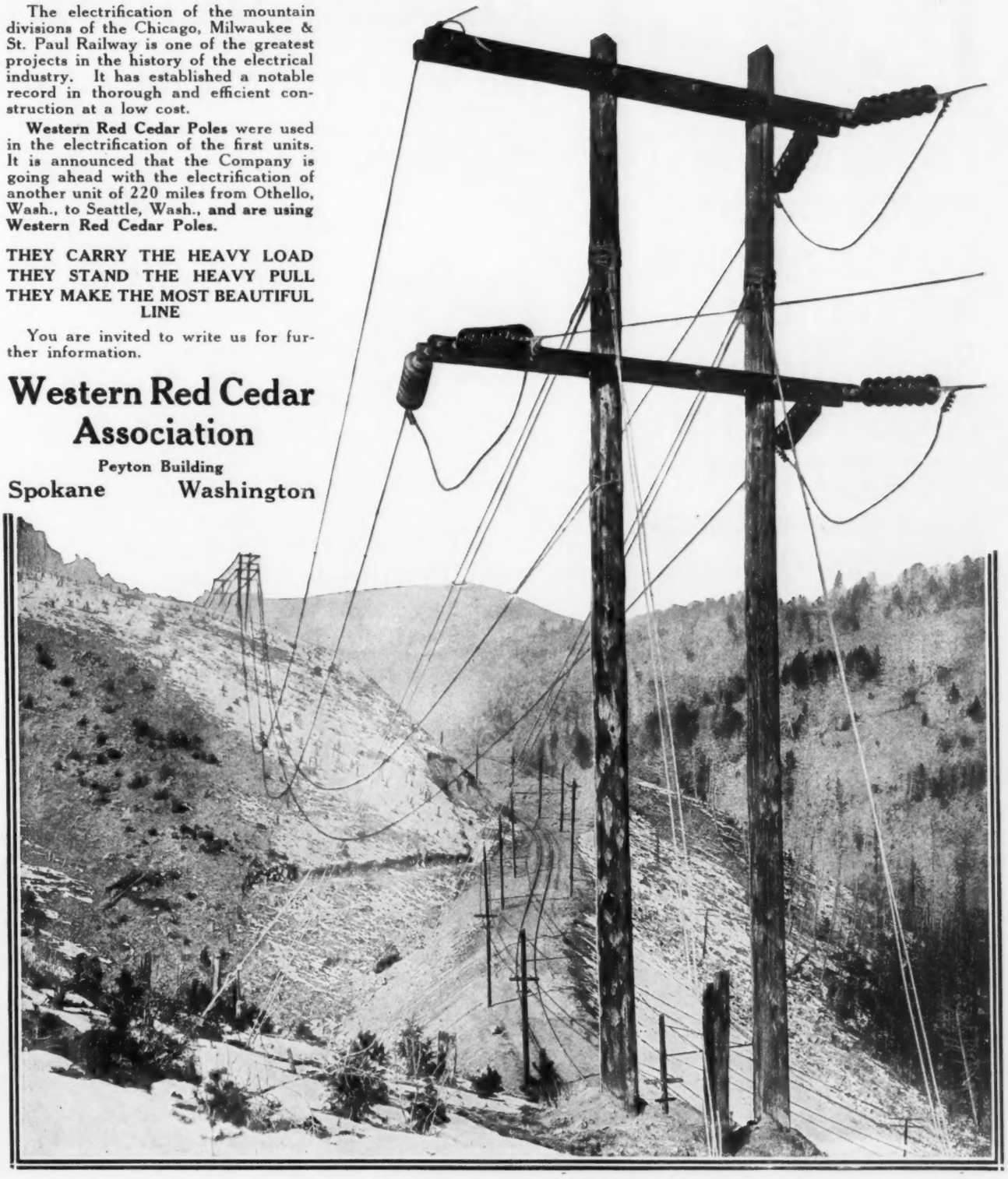
THEY CARRY THE HEAVY LOAD
THEY STAND THE HEAVY PULL
THEY MAKE THE MOST BEAUTIFUL LINE

You are invited to write us for further information.

Western Red Cedar Association

Peyton Building

Spokane Washington



On Chicago, Milwaukee & St. Paul Railway, 20 miles east of Butte, Montana. Weight supported by Pole Structure in foreground, 1,335 pounds. Height of Pole above ground, 30 ft.; length of Span, 970 ft.

We are a jump ahead of the demand

and want your orders for—

Designers and manufacturers of power station appliances

Specialists in high tension equipment.

Bus bar supports.

Clamp insulators.

Disconnecting switches,
(Indoor and outdoor types with and without locks.)

Cable end bells,
(Indoor and outdoor types.)

Switchboard fittings.

Copper connectors, Terminals, etc., etc.

Complete outdoor substation equipment.

Let us know your requirements.

District Offices.

Akron, Ohio, 337 Walsh Blk.
Birmingham, Ala., Jefferson Co. Bk. Bldg.
Boston, Mass., 84 State St.
Cincinnati, Ohio, Traction Bldg.
Cleveland, Ohio, 1417 Illuminating Bldg.
Denver, Colo., Gas & Electric Bldg.
Detroit, Mich., 616 Ford Bldg.
Kansas City, Mo., 1513 Grand Ave.
Los Angeles, Cal., 406 San Fernando Bldg.
Minneapolis, Minn., Film Exchange Bldg.
New Orleans, La., Hennen Bldg.
New York, N. Y., 21 Park Row.
Richmond, Va., 301 American National Bank Bldg.
Salt Lake City, Utah, 216 Judge Bldg.
San Francisco, Cal., Rialto Bldg.
St. Louis, Mo., La Salle Bldg.

ELECTRICAL ENGINEERS EQUIPMENT COMPANY

711-715 Meridian Street, Chicago, Ill.

Canadian Distributors—Northern Electric Co.—Ltd.

OUR MOTTO ECONOMY EFFICIENCY ENDURANCE

G&W *Electric Specialties—for the Ends of Cables*

Potheads for inside use are made in all sizes, shapes, and voltages.

On outside work it is, as a general rule, preferable to bend a cable rather than use a specially shaped pothead. But on inside work, where cables often come up in corners or behind switchboards in conduit, it is frequently better to provide specially shaped potheads.

Form "N" tubes mounted in Form "L" Pot

In the long experience of the G & W Company a large variety of special designs have been developed. Our catalog shows many styles for which we have patterns and in most cases a suitable shape can be selected from our stock.

In addition to those catalogued we can furnish on very short notice practically any pothead that may be wanted. G & W stock patterns are largely interchangeable and they can be put in shape for any special form very quickly.

Form "N," Form "P" and "Station Type" Potheads are non-disconnecting and for inside use only.

Form "L" and Form "M" are made disconnecting or non-disconnecting and are also furnished in a great variety of shapes for either inside or outside use. A choice of three forms of cable entrances may be used.

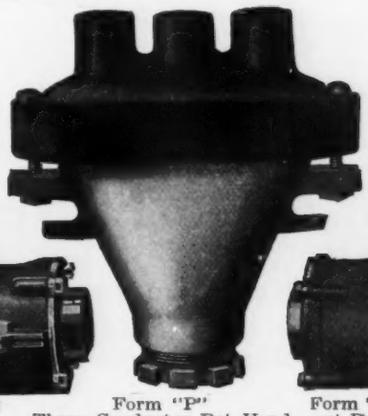
What kind of potheads do you need? Let us quote prices.

Form "N" — Three-Conductor Abutting Type of Casting

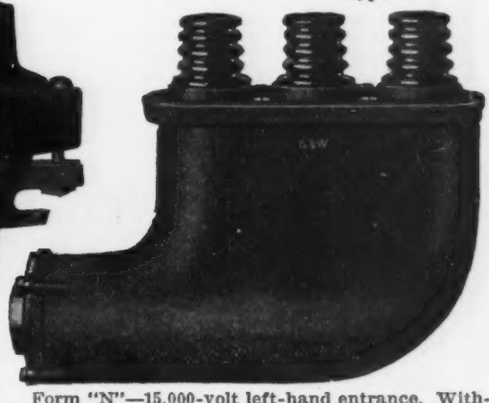
Form "N"—6,600 Volt Four-Conductor Projecting Type of Casting

Three-Conductor, Station Type

Form "N"—15,000-volt, half-tap type of casting With Brackets



Form "P" Three-Conductor Pot Head



Form "N"—15,000-volt left-hand entrance. Without Brackets. Made also for right-hand entrance

New York City, N. Y.: Lewis & Roth Co., 519 W. 38th St.
Philadelphia, Pa.: Lewis & Roth Co., 1012 Liberty Bldg.
Birmingham, Ala.: McClary-Jemison Machinery Co.
Los Angeles, Cal.: Chas. Farnham, 207 I. W. Hellman Bldg.
San Francisco, Cal.: Electric Material Co., 589 Howard St.
Seattle, Wash.: W. R. Hendrey & Co., Hoge Bldg.
Calgary, Alberta: General Supplies, Ltd., 122 W. 11th St.
Toronto, Ont.: A. H. Winter Joyner, Ltd., 100 Wellington St., W.

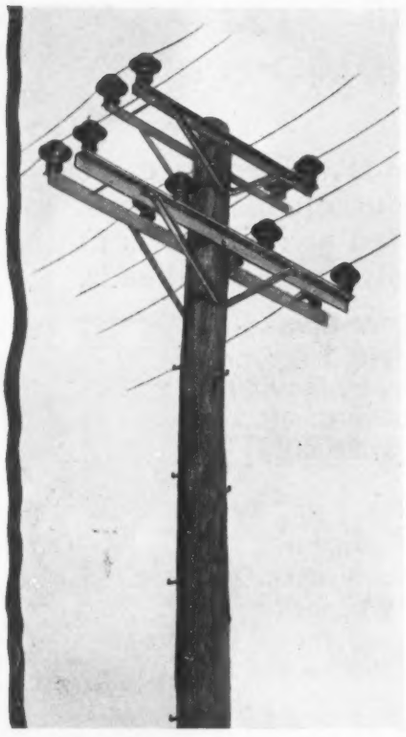
G&W ELECTRIC SPECIALTIES

G&W Electric Specialty Co.

7440 South Chicago Ave.
Chicago Illinois

We are Distribution Specialists

Hubbard Angle Cross Arm Brace



These one piece angle cross arm braces give greater strength and better alignment than can be secured with ordinary flat braces, and are particularly suitable for high voltage circuits. Nearly all such lines, with wood or angle steel arms, have angle braces.

Hubbard angle braces are bent hot from new open hearth steel and then hot dip galvanized, insuring that freedom from flaws and rust proof surface which characterize Hubbard products.

The brace is fastened to the arm by a carriage bolt at each end and to the pole by a lag screw.

On page 43 of the Hubbard Catalog standard sizes are listed, and we can make you any other size or type you require.

Hubbard and Company

Pittsburgh

New York **Chicago** **San Francisco**

Canadian Manufacturers and Distributors:
Acme Stamping & Tool Works, Hamilton, Ontario

The Hardware MAKES the Line—Hubbard Makes THE Hardware

Light Plant for Sale

In a growing town of 1000 near Cincinnati. Cash price $3,850, or $4,000 on time, requiring $2,000 down, balance on terms to suit. This is an exceptional opportunity for a young man to get into this business. Other business requires owners' attention, hence the sacrifice. Box 1135, Elec. World.

—hines

SOLD

"We received about 50 replies—

—some of these were from Canada, some from Cuba and one from Panama.

"* * * we could have sold a dozen plants if we had them.

"Your 'Searchlight' advertising certainly brings results and reaches the class of people who are interested in this line.

"Walton Electric Light Co."

The advertisement reproduced above cost only $1.50 an insertion and was published but five times, when the advertisers notified us to stop it as they already "could have sold a dozen plants." This is only one example among many of the selling power of Searchlight Section advertisements.

DO IT NOW!

Get your Wants into the Searchlight

ADVERTISING RATES

Positions Wanted, Evening Work Wanted, 3 cents a word, minimum charge 50 cents an insertion, payable in advance, less 10 per cent if one payment is made in advance for 4 continuous insertions.

Positions Vacant, Salesmen Wanted, Agencies, all undisplayed Miscellaneous ads, Machinery and Plants For Sale (with one line of display heading). 5 cents a word, minimum charge $1.50 an insertion.

All advertisements for bids cost $2.40 an inch.

Advertisements in display type cost as follows for single insertions:

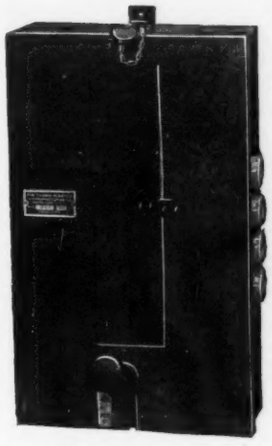
1-16 page,	$6.25	1 in. single col.,	$4.00
1-8 page,	12.50	4 in. single col.,	15.20
1-4 page,	25.00	8 in. single col.,	29.20

In replying to advertisements, send copies of testimonials, etc., instead of originals.

20

Safety First Switches

Fig. 1



The Switch can't close with the slide open.

The original thought that put the Safety First Switch on earth was that a switch operator should be protected against shock.

Palmer Switches and Cut-Outs make it impossible for a person to receive a shock either when operating the switch, or re-fusing a cut-out, no matter how the device is wired. This distinctive feature is found only in Palmer Switches; you need it if you need a Safety Switch.

Write for Bulletin M-17

Fig. 2

Your hand can't touch a live part.

30 to 400 Amperes

The Palmer Electric & Manufacturing Co.

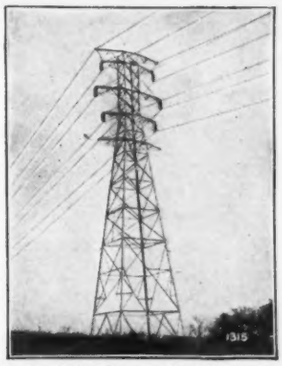
62 K Street, Boston, Massachusetts

250 to 3000 Volts

AMERICAN BRIDGE COMPANY

HUDSON TERMINAL-30 CHURCH STREET, NEW YORK

Manufacturers of Steel Structures of all classes particularly BRIDGES AND BUILDINGS



Transmission Towers, Pittsburgh, Pa. Duquesne Light Co.

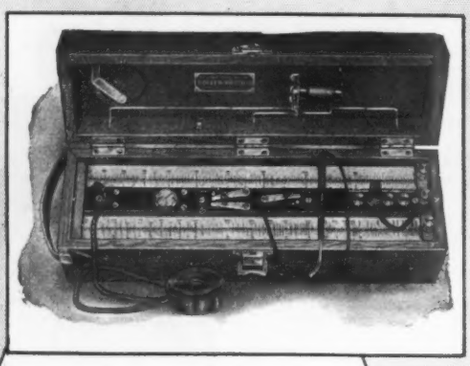
SALES OFFICES

NEW YORK, N. Y., 30 Church Street
Philadelphia, Pa. . Widener Building
Boston, Mass. . . John Hancock Bldg.
Baltimore, Md., Continental Trust Bldg.
PITTSBURGH, PA. . . Frick Building
Buffalo, N. Y. . Marine National Bank
Cincinnati, Ohio. Union Trust Building
Atlanta, Ga. . . . Candler Building
Cleveland, Ohio . . Guardian Building
Detroit, Mich., Beecher Ave. & M. C. R. R.
CHICAGO, ILL., 208 South La Salle St.
St. Louis, Mo., Third Nat'l Bank Bldg.
Denver, Colo., First Nat'l Bank Building
Salt Lake City, Utah, Walker Bank Bldg.
Duluth, Minn. . . . . Wolvin Building
Minneapolis, Minn., 7th Ave & 2nd St. S. E.

Pacific Coast Representative:

U. S. Steel Products Co. Pacific Coast Dept.
SAN FRANCISCO, CAL., Rialto Building
Portland. Ore. . . . . Selling Building
Seattle, Wash., 4th Ave. So. Cor. Conn. St.

Export Representative:
United States Steel Products Co., 30 Church St., N. Y.



Don't "Compute" Resistance

Don't bother with laborious resistance calculations. Old-time "rule-of-thumb" methods like that are unnecessary now.

Use the ROLLER-SMITH (Sage) OHMMETER

—take your resistance readings *direct from the scale* without computation. Four scales, giving a very wide range of measurement. Complete, compact, convenient. Supplied in *Telephone Type* or *Galvanometer Type*. Let us explain to you the many practical advantages of these instruments.

Get Bulletin No. 300.

Roller-Smith Company

Main Office and Export Dept.

233 Broadway, New York

CHICAGO	FACTORY	CLEVELAND
Monadnock Block	Bethlehem, Pa.	Williamson Bldg.

BALTIMORE.....Equitable Bldg.
BIRMINGHAM.....Brown-Marx Bldg.
BOSTON.....136 Federal St.
DENVER.....1633 Tremont St.
DETROIT.....Majestic Bldg.
KANSAS CITY.....600 East 15th St.
MINNEAPOLIS.....Builders' Exchange
PHILADELPHIA.....Drexel Bldg.
SAN FRANCISCO.....589 Howard St.
SEATTLE.....Pacific Block Bldg.
ST. LOUIS.....Railway Exchange Bldg.

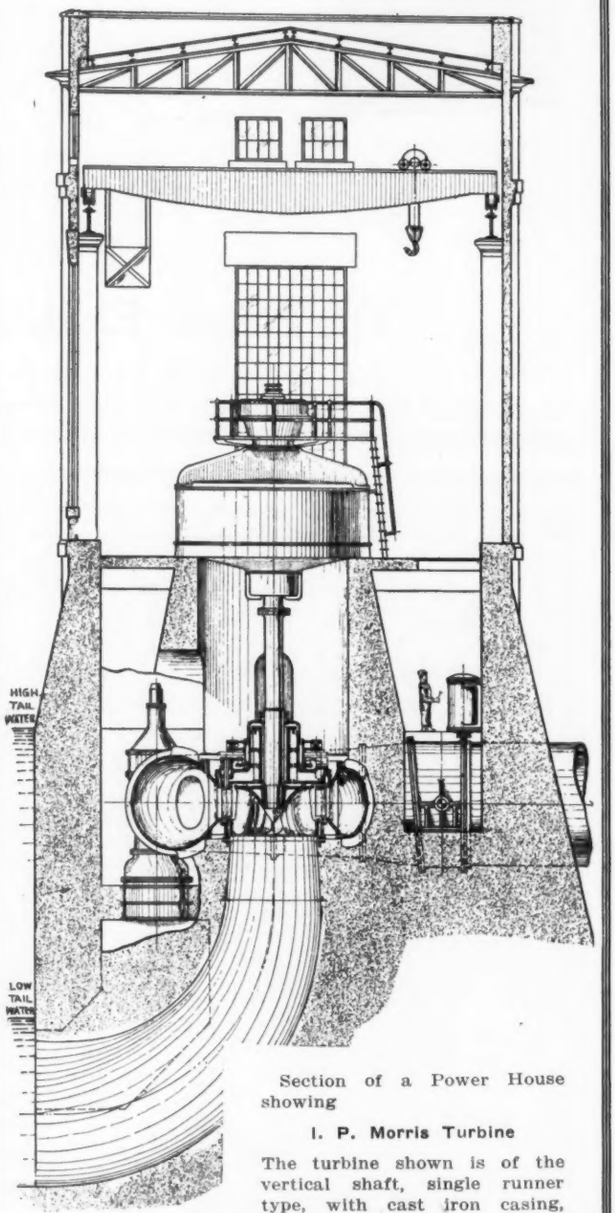
I. P. Morris Department

of

THE WILLIAM CRAMP & SONS SHIP AND ENGINE BUILDING COMPANY

Richmond and Norris Streets

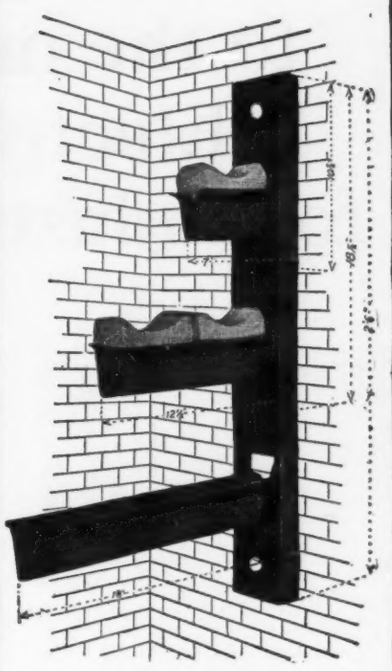
PHILADELPHIA



Section of a Power House showing

I. P. Morris Turbine

The turbine shown is of the vertical shaft, single runner type, with cast iron casing, designed to operate under a head of 115 feet and to deliver 13,200 horse-power; installed in the Bridgewater Station of the Western Carolina Power Company.



Metropolitan Subway Cable Racks, illustrating flexibility of assembly to meet all conditions of service.

Your Cables are Protected

against Electrolysis, Burnouts Chafing or similar troubles when you use Metropolitan Subway Cable Racks

Let Us Send You Full Particulars.

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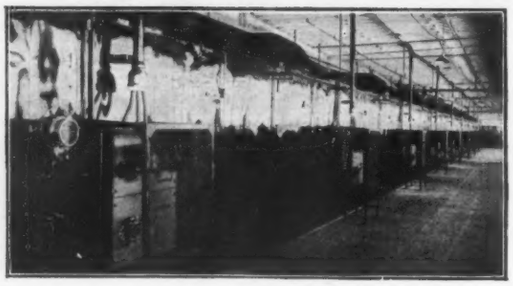
ITE

A Breaker *for* Every Service

FOR the protection of DIRECT CURRENT GENERATORS operating in multiple, use REVERSITE Circuit Breakers, made with or without Overload Feature in Single or Multipolar forms, for either Manual or Remote Control, as may be desired.

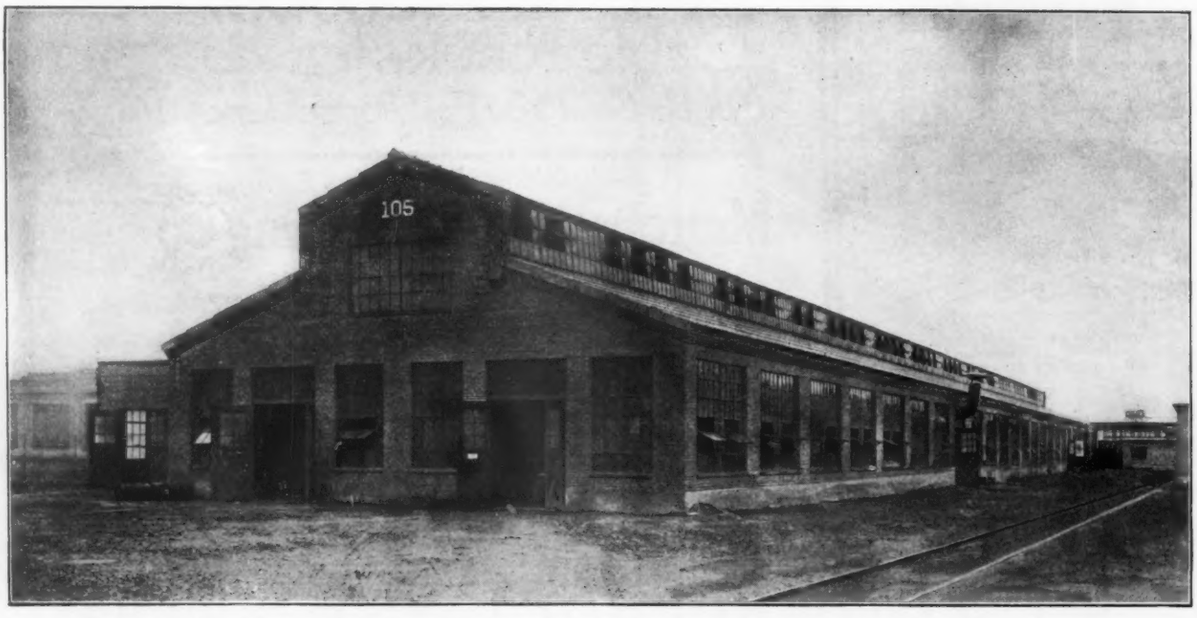
7

THE CUTTER CO. PHILADELPHIA

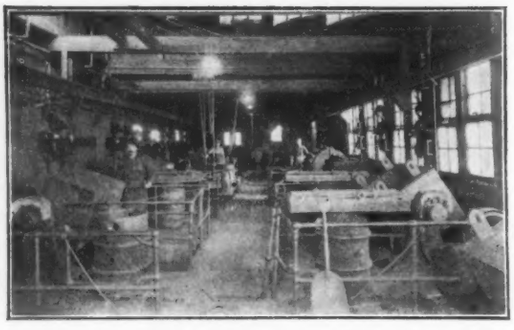


Electrically Heated Ovens

A Building De to the manu Electrical for Industrial



Exterior of G. E. Heating Factory



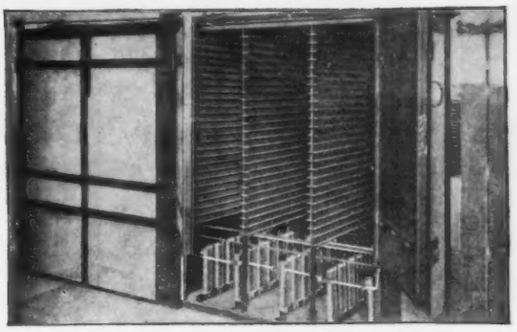
Electric Sherardizing Plant

The General Electric Company is now prepared to furnish a wide range of electric heating equipment for industrial plants. A corps of heating engineers and specialists has been organized to analyze your problems and suggest the best methods for solving them.

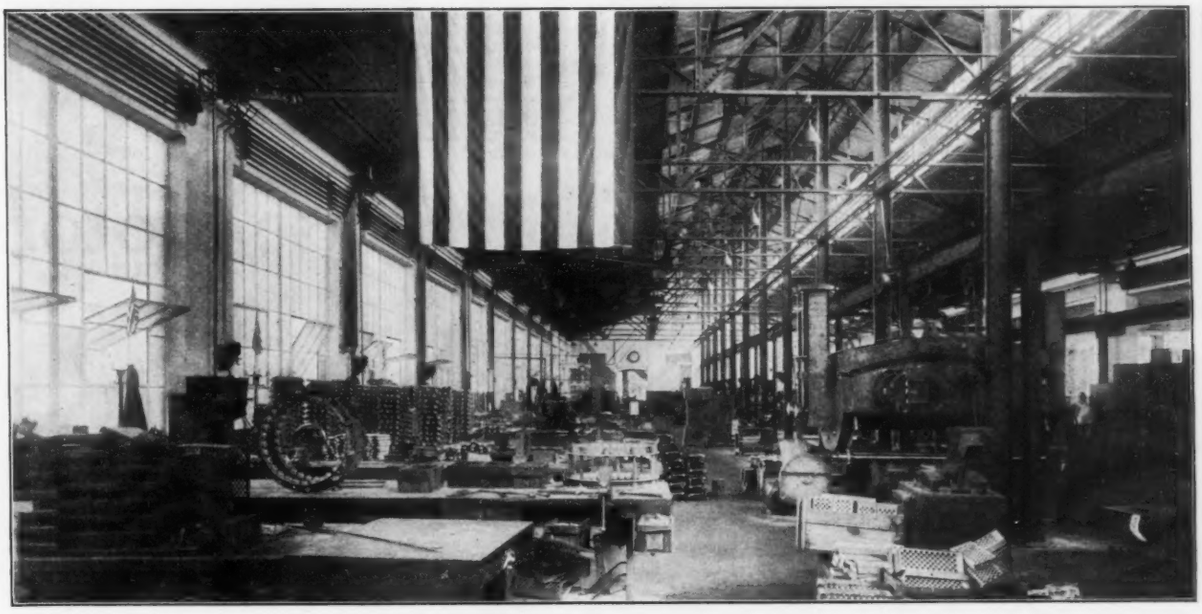
General Electric Company

General Office: Schenectady, N. Y. Sales offices in all large cities

voted exclusively facture of Appliances Heating

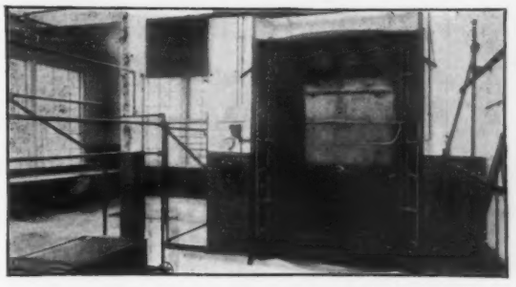


Electric Japanning Ovens



Interior of G. E. Heating Factory

To Central Stations: An interview with possible customers on your lines will create an interest in electric heating and a desire for more definite information. Turning over these inquiries to the General Electric Company will place at your disposal the assistance and experience of its corps of heating engineers.



Electric Revolving Oven

7224

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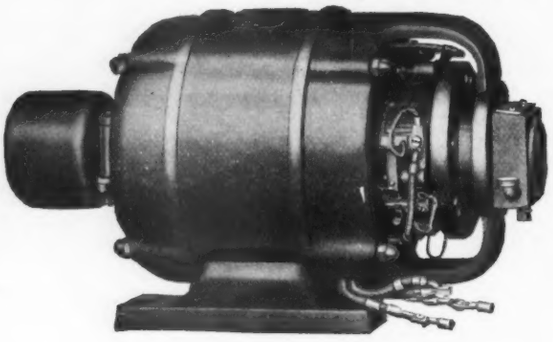
The Standard RI Motor is reversible



The RI Motor is built in sizes ¼ to 20 H. P. 110 or 220 volts

Stock Shipments on small RI Single Phase Motors

The enormous production facilities of the General Electric Company are responding to the demand for small single phase motors.

Stock shipments can be made on the ¼, ½ and ¾ 1800 r.p.m. sizes.

If you have several machines to drive—don't wait to order line shafting, pulleys, etc.—just split up the drive—apply one of these sturdy little motors to each machine. Hundreds of small applications are waiting for such a drive.

And here's an opportunity in the large shops—apply some of your present group drive motors to the larger machines and split up the remaining group units for individual drive, making use of small single phase RI motors.

Call, write or phone our nearest office for prompt shipment on the small RI Motors.

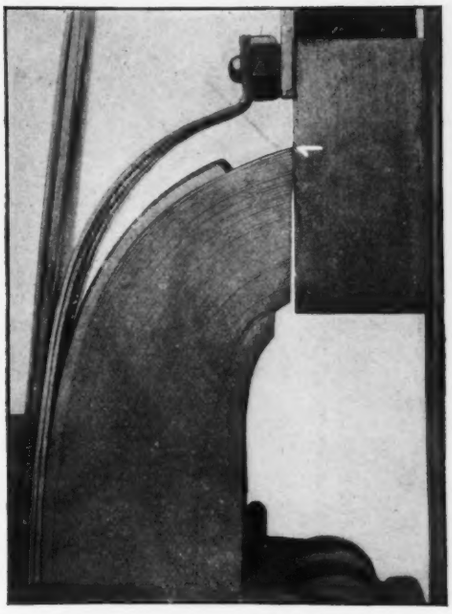
7184

General Electric Company

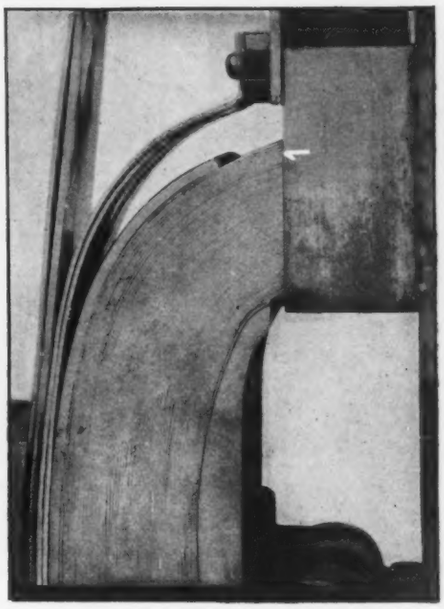
General Office: Schenectady, N. Y. **Sales offices in all large cities**

The Why of G-E Air Circuit Breaker Efficiency

The Self-Cleaning Brush



Upper End of Brush Just Making Contact



Brush Closed, Showing Extent of Wiping

As a G-E air circuit breaker is being closed, each brush lamination meets the contact block individually and then slides over the face of the block with gradually increasing pressure until the movement is completed.

This wipes the end of the brush and the face of the contact block at each closing operation, and insures clean contact surfaces.

Careful attention to details, large and small, gives the G-E air circuit breaker great reliability.

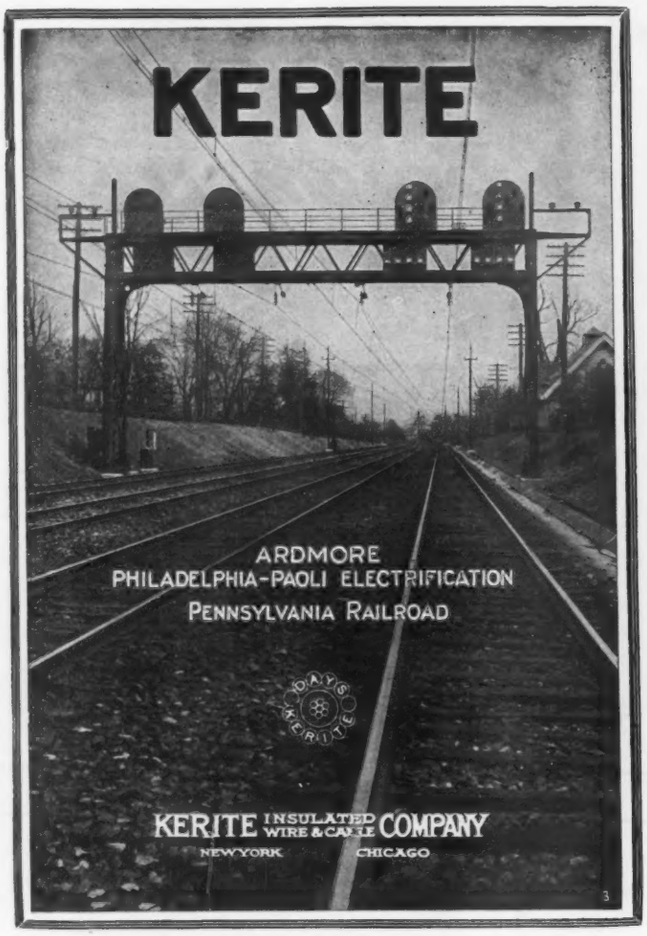
End-on contact under heavy pressure against clean contact surface.

SET it—then FORGET it

General Electric Company

General Office: Schenectady, N. Y. **Sales offices in all large cities**

6757



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RUBBER COVERED WIRES & CABLES
If its PARANITE its right
More than meets code requirements
Underground, Aerial, Submarine and Inside Use, Telephone, Telegraph, Fire Alarm, Electric Light and Power Wires and Cables.
THE BEST FOR EVERY PURPOSE
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QUALITY AND SERVICE go hand in hand
OKONITE *quality* is universally recognized as Standard because of its never f.iling reliability, permanence and economy.
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501 Fifth Avenue
New York
1

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201 DEVONSHIRE ST. BOSTON
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1638

Whatever the Desired Feature May be, You Can Give it With an R & M Fan

Whether it is light weight, pleasing design, attractive finish, quiet operation, low current consumption or long life that the customer wants most, you can meet the demand with a Robbins & Myers Fan and clinch the sale.

The drawn steel frame and base used in all R & M Fans makes them so light in weight that a child can carry them from room to room.

The graceful lines of the fans appeal to every one and the finish is as fine as the finish of the best piece of furniture. The felt pad on the base permits the fan to be placed on any piece of furniture without injury to the finish.

All R & M Fans operate quietly, and where extra quiet operation is required they can be supplied in the silent six-blade construction.

Their reliability and long life have won the favor of all dealers who have had experience with them, and in point of operating efficiency they meet the most exacting requirements.

And your customers know about these quality features of Robbins & Myers Fans. Ten years of persistent advertising in the leading magazines have made them favorably known to every one.

When you point out the quality feature of R & M Fans to your customers you confirm the opinion they already have of these fans, and easy sales are the result.

The line is complete, containing all popular styles and sizes for operation on all direct and alternating current circuits.

THE ROBBINS & MYERS COMPANY

SPRINGFIELD, OHIO

New York Boston Philadelphia Buffalo Cleveland Cincinnati Chicago St. Louis San Francisco

Robbins & Myers Fans

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General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.
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Engineers and Contractors
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Get your Wants into the Searchlight

Josh Billings said:

"I luv the rooster for 2 things. For the crow that iz in him and for the spurs he has got to bak up the crow with."

All the arguments in the world wouldn't persuade so many people to use the "Want" and "For Sale" pages of Electrical World unless the paper showed results with which to back up the arguments.

Look at the Searchlight advertisements in this issue

80

Card Index ELECTRICAL WORLD, JUNE 23, 1917 Vol. 69

A New Trail Blazed in California....1193
Give Us More Water Pressure....1194
Centralizing Energy Production from Fuel....1195
Timely Economy of Industrial Electric Trucks....1196
Some Economies Effected by Means of Electric Heat. By A. F. Allsop....1199
Why Hydroelectric Development Lags. By Hugh L. Cooper....1200
Legal Requirements of Factory Lighting. By C. E. Clewell....1203
Working Toward Saturation in Thirty-two Towns. By Arthur Huntington....1207
Standardization in Outdoor Substations....1209
Cost Data on Installation for Lighting City Streets....1211
Elements Involved in Rate Investigation....1213
Electrical Supplies Needed by Cantonments....1220
Pooling of Coal and of Its Distribution Recommended....1220
War-Time Economic Benefit of Transmission Tie Lines....1224
Agency System Extended to Central Stations in Lamps....1232
Post-War Foreign Trade Competition Measures....1232
Foreign Incandescent Lamp Prices Advance....1232
Adequate Reserves Held Against Lower Prices....1233

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AMERICA'S MARKET FOR

ELECTRICAL MACHINERY

Where you can SELL your machines for cash any time. Where you can BUY with confidence—Gregory square dealing has made it the most powerful single factor in the used Electrical Machinery field today.

We handle late type machines, not taken out of service because worn out or defective, but in first-class usable condition. Every machine sold is completely overhauled and fully tested at our works before shipment and is sent out practically new. Send for our Monthly Bargain Sheet showing complete stock with net prices.

For Sale—
125 Volt D. C. Generators

Kw.		Speed
1	10 Westinghouse, type S	1125
4	11¼ Westinghouse, type M	1200
1	12½ Triumph	1100
1	12½ Thresher	925
1	15 Hobart, with flywheel	1150
4	15 Northern	900
1	16 Fairbanks-Morse	1050
2	17 Westinghouse, type S	1125
1	17½ Roth, MP	760
1	18 Crocker-Wheeler	800
1	20 Triumph	940
1	25 Ft. Wayne	875
1	25 Triumph	775
1	25 Western Elec	575
1	25 Gen. Elec., direct-connected to Westinghouse gas or gasoline engine	350
1	30 Northern	1400
1	30 Westinghouse	950
1	33 Milwaukee	1125
1	35 Sprague, direct-connected to De Laval steam turbine	1500
1	35 Triumph	875
1	50 Triumph	1025
1	50 Western Elec.	550
1	50 Western Elec., direct-connected to Ideal engine	275
1	55 Gen. Elec.	875
1	56¼ Westinghouse, type M	525
1	60 Westinghouse, type M	800
1	65 C. & C.	650
1	65 Crocker-Wheeler	625
1	75 Sprague, direct-connected Ideal engine	283
1	100 Westinghouse, direct-connected to Harrisburg tandem-compound engine	275
1	125 Milwaukee	450

250 Volt D.C. Generators

Kw.		Speed
1	6 Fairbanks-Morse, MP	1425
1	15 Westinghouse, MP, type M	1050
1	22½ Northern, MP	1000
1	25 Westinghouse, MP, type S	700
1	30 C. & C., type MP, direct connected to 9 x 12 in. Skinner auto. engine	325
2	50 Commercial, MP	600
1	50 Western Elec., 6-pole, type LL4E, 3-wire, 125-250-volt generator, direct-connected to 11x12 in. 4-valve Chuse horizontal auto. self-oiling engine, with accessible stuffing-box and Rites governor	290

60 Cycle Generators

Kva.		Speed
1	37½ Fort Wayne, 3-phase, 1100 or 2200 v.	1200
1	37½ Fort Wayne, 2-phase 1100-2200 v.	1200
1	50 Westinghouse, 2-phase, rev. field, 2300 v	1200
1	75 Fairbanks-Morse, 3-phase, rev. field, 2300 v	1200
1	75 Westinghouse, 3-phase, rev. field, 240 volts, with exciter	900
1	100 Crocker-Wheeler, 3-phase, 2300 volts, rev. field, direct-connected to Harrisburg engine	257
2	120 Allis-Chalmers, 240 volts, rev. field	900
1	100 Westinghouse, 3-phase, revolving field, 2300 volts, direct-connected to McEwen engine	257
1	120 Westinghouse, 3-phase, 2200 v.	720
1	150 Allis-Chalmers, 240 v. turbine, very fine, just overhauled at factory	
1	180 Westinghouse, 3-phase, 440 v	514

Two Phase, 60 Cycle A. C. Motors

HP.		Speed
2	5 Westinghouse, type CS, 220 vo., new	1735
2	5 Gen. Elec., type KQ, 220 v., new	1200
1	10 Gen. Elec., form K, 220 v	1200
3	15 Fairbanks-Morse, 220 or 440 v., slip-ring, constant speed (20 H.P. intermittent rating), new, with starter	1200

3 Phase, 60 Cycle Motors 220 Volts

HP.		Speed
2	2 Gen. Elec.	1800
2	2 Globe	1165
6	2 Triumph	1140
5	2 Triumph	850
12	3 Gen. Elec.	1800
1	3 Globe	1750
12	3 Allis-Chalmers, 220 or 440 v	1750
2	8 Westinghouse, type CS	1730
1	3 Allis-Chalmers, 440 v.	1140
2	3 Westinghouse	1120
5	3 Triumph	850
1	3½ Fairbanks-Morse, 220 v., slip-ring, variable speed	1200
1	3½ Allis-Chalmers	1130
1	5 Fairbanks-Morse, 220 or 440 v., slip-ring, variable speed	900
1	5 Gen. Elec.	900
1	5 Gen. Elec.	720
1	6 Gen. Elec. (intermittent rating), slip-ring, variable speed	785
3	7½ Fairbanks-Morse	1800
2	7½ Howell Elec. Co.	1800
1	7½ Wagner, 440 v	1730
2	7½ Allis-Chalmers	1700
2	7½ Howell Elec. Co.	1200
3	7½ Fairbanks-Morse, slip-ring, variable speed	900
1	10 Richmond, 440 v.	1720
1	10 Howell Elec. Co.	1200
1	10 Jenney	1200
4	10 Westinghouse	1120
4	10 Fairbanks-Morse, 220 or 440 v., slip-ring	900
4	10 Allis-Chalmers	860
1	12 Gen. Elec., 110 v.	720
1	12 Gen. Elec., 550 v.	720
1	15 Gen. Elec., 440 v.	1800
2	15 Watson, 220 or 440 v., slip-ring, variable speed	1720
1	15 Fairbanks-Morse, 440 v.	1200
1	15 Gen. Elec., form L	1200
1	15 Gen. Elec., 440 v.	1200
2	15 Fairbanks-Morse, 220 or 440 v., slip-ring	1200
2	15 Westinghouse	850
1	15 Fairbanks-Morse.	600
3	20 Westinghouse	1750
1	25 Gen. Elec., slip-ring, 220 or 440 v.	1200
3	30 Westinghouse	1750
1	30 Fairbanks-Morse.	1200
1	35 Crocker-Wheeler.	1140
1	35 Gen. Elec., 220/-440 v.	900
1	50 Lancashire	1140
1	50 Crocker-Wheeler, 440 volts	1160
1	75 Allis-Chalmers, 220 or 440 v.	490

3 Phase, 40 Cycle, 550 Volts

HP.		Speed
2	10 Westinghouse	1120
3	15 Westinghouse	1120
3	20 Westinghouse	1120
2	30 Westinghouse	760

3 Phase, 25 Cycle

HP.		Speed
1	2 Gen. Elec.	1500
5	6 Gen. Elec.	750
2	6 Gen. Elec.	1500
1	8 Gen. Elec.	1500
12	10 Gen. Elec.	750
1	10 Gen. Elec.	1500
1	10 Fairbanks-Morse.	750
4	12 Gen. Elec.	1500
1	15 Fairbanks-Morse.	1500
4	15 Gen. Elec.	750
2	20 Gen. Elec.	750
1	20 Fairbanks-Morse.	750
1	25 Gen. Elec., form L	750
1	100 Westinghouse, 480 v. synchronous, late type	500

SEARCHLIGHT SECTION

1—1250 K.V.A. WESTINGHOUSE HORIZONTAL TURBO GENERATING UNIT WOUND FOR 3 PHASE, 60 cycles, 2200 volts. Unit complete with 4500 sq. ft. Worthington surface condenser, circulating pump, rotative dry vacuum pump and wet vacuum pump; also all intermediate piping and connections. Steam end designed for 150 lbs. steam pressure. Turbine fitted with Bronze blading.

1—500 K.W. WESTINGHOUSE HORIZONTAL TURBO GENERATING UNIT WOUND FOR 3 PHASE, 60 CYCLES, 2300 volts, speed 3600 RPM., condensing duty. Immediate shipment.

1—500 K.W. GENERAL ELECTRIC CURTIS STEAM TURBINE, 3 PHASE, 60 CYCLE, 1800 RPM., 2300 VOLTS, 150 lb. steam pressure, vertical type. Surface Condenser.

DIRECT CONNECTED DIRECT CURRENT UNITS

1—250 K.W. three wire unit consisting of 2—125 K.W. Crocker-Wheeler type CCD., 125 v., 8 pole, 250 rpm., direct connected to 15½ and 31 x 16" Ball & Wood center crank tandem compound engine.
1—125 K.W. Westinghouse 3 wire, 125/250 v., 500 amp., 280 rpm. generator, direct connected to a 14 and 24 x 14 Westinghouse engine.
1—100 K.W. three wire unit, consisting of 2—50 K.W. Allis-Chalmers 6 pole, 275 rpm., 125 v. generators, direct connected to vertical cross compound Reeves engine, 10 and 18 x 12".
1—35 K.W. Crocker-Wheeler compound wound, 250 v., 350 rpm. generator, direct connected to 10 x 10 Ames engine.
1—30 K.W. General Electric, 125 v., 305 rpm. generator, direct connected to a vertical Marine engine.
2—25 K.W. Crocker-Wheeler, 125 v., 200 amp., 325 rpm., type CCD generators, direct connected to Forbes Marine engines.

DIRECT CONNECTED ALTERNATING CURRENT UNITS

1—250 K.W. General Electric 3 ph., 60 cy., 2300/4000 v., 36 amp., 150 rpm., Rev. field type alternators, direct connected to 15¼ and 28½ x 30" Buckeye cross compound engine.
1—125 K.W., 3 ph., 60 cy., 2300 v. Allis-Chalmers direct connected to a 12 x 23 x 16 Tandem Compound Skinner engine.

BELTED ALTERNATING CURRENT DYNAMOS

1—350 K.V.A. General Electric, type ATB, 3 ph., 60 cy., 6600 v., 450 rpm. (can be reconnected for either 240 or 480 v.).
1—300 K.W. Westinghouse 3 ph., 60 cy., 2300 v., 3 bearing design, 300 rpm. (can be connected for 600 v.).
1—225 K.V.A. Allis-Chalmers 3 ph., 60 cy., 440 v., 900 rpm. revolving field type generator.
1—200 K.W. General Electric, 2300 v., 3 ph., 60 cy., 600 rpm., type ATB generator.
1—100 K.W. Allis-Chalmers 3 ph., 60 cy., 2300-4000 v., 900 rpm. generator.
1—100 K.V.A. General Electric 3 ph., 60 cy., 2300 v., 900 rpm.
1—75 K.W. Westinghouse 3 ph., 60 cy., 2300 v., 900 rpm.
1—75 K.V.A. Allis-Chalmers 3 ph., 60 cy., 2300 v., 900 rpm.

INDUCTION MOTORS

1—200 H.P. Burke 3 ph., 60 cy., 220 v., 720 rpm., slip ring type.
1—200 H.P. Westinghouse 3 ph., 60 cy., 440 v., 600 rpm., type CS motor. NEW.
1—135 H.P. Allis-Chalmers slip ring type, 3 ph., 60 cy., 550 v., 400 rpm., with controllers and resistance.
1—100 H.P. Westinghouse, type CW, 3 ph., 60 cy., 440 v., 585 rpm. slip ring type motor.
1—75 H.P. Westinghouse, type CS, 3 ph., 60 cy., 440 v., 700 rpm. squirrel cage motor.
1—75 H.P. Westinghouse, type CS, 3 ph., 60 cy., 220 v., 700 rpm. squirrel cage motor.
1—75 H.P. Westinghouse, type CW, 3 ph., 60 cy., 440 v., 580 rpm. slip ring type motor.
2—50 H.P. General Electric, type I, 3 ph., 60 cy., 440 v., 1200 rpm. motors.
1—50 H. P. Westinghouse, 2 ph., 60 cy., 440 v., 1170 rpm. motor, type CS.
1—30 H.P. Fairbanks Morse, type B, 3 ph., 60 cy., 440 v., 1200 rpm. motor.

TRANSFORMERS

6—750 K.V.A. General Electric, 4400/2200-488/281 volts.
3—500 K.W. General Electric, O. I. W. C., 66000-62700-59400-22000-20900-19800 to 4400-2200.
3—375 K.V.A. Allis-Chalmers, O. I. S. C. indoor type transformers, 25 cy., 2300-367 volts.
3—350 K.V.A. General Electric, type H, 60 cy. transformers, 2400/2300/2200 volts prim., 200/400 volts secy.

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ELECTRIC & STEAM MACHINERY SECOND HAND
Federal Reserve Bank Bldg., ST. LOUIS, MO.
DIRECT CONNECTED A.C. UNITS (60 CYCLES)

K.W.	Make	Volts	Ph.	Engine Description
2—1250	Westge.	2200	3	to Westge. Parsons Cond. Turbine
1100	Westge.	2300	2 or 3	to 24&50x60 Allis C. C. Cor.
850	Westge.	2400	3	to Cross Comp. Buckeye 120 R.P.M.
800	Allis	220-440	3	to 26&44x48 Allis C. C. Corliss
600	Westge.	2300	2 or 3	to 26&40x48 L.& B.Cor. C.C.,100 Rev.
4— 500	Westge.	2300	3	to Westge. Par. Turbines, 3600 Rev.
400	G. E.	2300	3	to 18&32x36 Pa. Ir. Wks., C. C. Cor.
400	C. W.	any	2 or 3	to 18&30x48 Ham. C. C. Cor.
2— 375	Westge.	440	3	to Parsons Hor. Turbines
300	G. E.	2300	2 or 3	to 19&32x22 McEwen Tan. Com. 150R.
2— 300	Westge.	2300	2 or 3	to 26&30 Fitchburg, 150 R., perf. con.
250	Westge.	440	3	to 16&28x24 Erie Ball C. C.
250	Westge.	2200	2 or 3	to 18&30x16 Westge. Vert. C. C.
250	Westge.	2200	3	to Wisconsin Hor. Corliss Eng. 18x36
2— 156	Westge.	240-480	3	to Westge. Parsons, Turb., Non-Cond.
2— 125	——	220	3	to 14¼x18 Buckeye Simple
150	G. E.	240	3	to Chandler & Taylor Simple
2— 100	G. E.	2300	3	to Curtis Turb., 1 Cond., 1 Non-Cond.

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We probably have just what you require—Try us.

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2—425 Kw. R. F. Bullock 2200 volt, 2 or 3 phase, 150 RPM Generators direct connected to 2-26 and 42x27, Erie Ball Horizontal Cross Compound Engines complete with accessories.
1—350 Kw., 6600 volt, 25 cycles, 3 phase, General Electric. Complete with switchboard direct connected to cross compound Buckeye Engine.

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FOR SALE

5—250 K.W. General Electric Transformers, 6200 to 460 Volt.
1—120 H.P. Gen. Elec. Synchronous motor, 3 Phase, 60 Cycle, 440 Volt, 300 R.P.M.
1—100 K.W. General Electric Transformer, 6200 to 460 Volt.
1—65 K.W. Northern D.C. Generator, 250 Volt, 900 R.P.M.
1—62½ K.W. Milwaukee D.C. Generator, 250 Volt, 950 R.P.M.
1—60 K.W. Gen. Elec. Generator, 250 Volt, 925 R.P.M.
1—55 K.W. Westinghouse D.C. Generator, 250 Volt, 800 R.P.M.
2—50 K.W. Elec. Mchy. Co. D.C. Generators, 250 Volt, 750 R.P.M.
1—50 H.P. Gen. Elec. D.C. motor, 500 Volt, 900 R.P.M.
1—40 K.W. Crocker-Wheeler D.C. Generator, 250 Volt, 1200 R.P.M.
1—35 H.P. Gen. Elec. D.C. motor. 500 Volt, 950 R.P.M.
2—30 H.P. Gen. Elec. D.C. motors, 500 Volt, 625 R.P.M.

The above is only a partial list. We also have a large stock of engines, boilers, pumps, compressors, etc. Write us your requirements or send for our complete stock list.

MORSE BROS. MACH'Y & SUPPLY CO.
Denver Colorado

IMMEDIATE SHIPMENT

1—100 K.W., 250 V., D.C. STEAM ENGINE GENERATOR SET.
1—37½ K.W., 250 V., D.C. STEAM ENGINE GENERATOR SET.
1—60 K.W., 250 V., D.C. GAS ENGINE GENERATOR SET.
1—17½ K.W. 125 V., D.C. GAS ENGINE GENERATOR SET.
1—62 K.W., 560 V., D.C. GAS ENGINE GENERATOR SET.
1—90 K.W., 500 V., D.C. GAS ENGINE GENERATOR SET.
1—500 K.W., 550 V., D.C. GENERATOR Belted to Synchronous Motor, 2200 V., 3 PH., 60 CY.
1—100 H.P., 2200 V., 720 R.P.M., 3 ph., 60 cy., NEW INDUCTION MOTOR.
2— 75 H.P., 440 V., 860 R.P.M., 3 ph., 60 cy., NEW INDUCTION MOTOR.
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1—500 KW. set consisting of one 500 KW. Allis Chalmers generator, 250 volts, interpole, 600 RPM., dir. conn. to Allis Chalmers synchronous motor, 3 ph., 60 cy., 2300 volts.

1—375 KW. set consisting of one 375 KW. Gen. Elec. type MP compound wound generator, 7 pole, 600 volts, direct connected on common base to 400 KW. Gen. Elec. synchronous motor, ATI, 3 ph., 60 cy., 2300 volts, 12 pole, 600 RPM., with dir. conn. exciter.

1—300 KW. set consisting of two 150 KW. Gen. Elec. type MP shunt wound generators, 6 pole, 140 volts, 720 RPM., on common base and direct coupled one on each end of shaft of 450 HP. Gen. Elec. form K motor, 3 ph., 60 cy., 4000-2300 volts, 10 pole, 720 RPM.

1—300 KW. set consisting of one 300 KW. Westinghouse 220 volt shunt wound generator, dir. conn. to 400 HP. Westg. type CX motor, 3 ph., 60 cy., 440 volts, 720 RPM.

1—250 KW. set consisting of one 250 KW. Westg. 250-125 volts, 3-wire generator, dir. conn. on common base to one 400 HP. Westg. CCL motor, 2 ph., 60 cy., 2200 volts, 14 pole, 514 RPM.

1—175 KW. set consisting of 175 KW. Allis Chalmers 250-275 volt motor, 4 pole, compd. wd., dir. conn. on common base to 290 HP. Allis Chalmers squirrel cage motor, 2 ph., 60 cy., 2300 volts, 850 RPM.

1—150 KW. set consisting of one 150 KW. Allis Chalmers compd. wd. generator, 600 volts, dir. conn. on common base to 225 HP. Allis Chalmers motor, 3 ph., 60 cy., 440 volts, 1150 RPM.

1—150 KW. set consisting of one 150 KW. Gen. Elec. type DLC generator, 140-280 volts, 3-wire, dir. coupled on common base to 225 HP. Gen. Elec. motor, 3 ph., 60 cy., 4000-2300 volts, 8 poles, 900 RPM.

1—37½ KW. set consisting of 37½ KW. Westg. type M generator, 250 volts, dir. coupled to 50 HP. Westg. CCL motor, 3 ph., 60 cy., 220 volt, 850 RPM.

1—35 KW. set consisting of 35 KW. Bullock generator, 120 volts, dir. conn. to 50 HP. Westg. type C motor, 2 ph., 60 cy., 850 RPM.

1—10 KW. set consisting of one 10 KW. Allis Chalmers generator, 120 volts, on common shaft and bed plate with 15½ HP. Allis Chalmers motor, 3 ph., 60 cy., 440 volts, 1130 RPM.

ROTARY CONVERTERS—60 CYCLE

1—600 KW. Westinghouse rotary converter, 6 pole, compd. wd., 600 volts D.C., 424 volts A.C., 1200 RPM., with three 185 Kva. Westinghouse OI SC single phase transformers, 2300 volts primary, also suitable switchboard equipment.

1—300 KW. Westinghouse rotary converter, 525-575 volts D.C., 600 RPM., with two 165 KW. Westg. oil insulated transformers, 2200 volts primary, 367 volts secondary.

2—300 KW. General Electric rotary converters, type HC, form P, 8 pole, 3 ph., 60 cy., 600 volts D.C., 500 amps., 900 RPM. With each rotary there are three 110 KW. Gen. Elec. type AB, form BI, 60 cycle transformers, 13,200 volts prim., 430 volts secondary, also panels with necessary instruments.

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Alternating Current Direct Connected Sets

50 K.V.A. Ft. Wayne 2, 60, 2300 V., 300 R.P.M., Type QRE, to 11" x 10" Fleming Harrisburg engine, with exciter and belt.
105 K.V.A. Ft. Wayne, 2, 60, 2300 V., 257 R.P.M., Type QRE, to 14" x 13" Fleming Harrisburg engine with exciter and belt.

Direct Current Direct Connected Sets

1½ K.W. Engberg, 115 V., 750 R.P.M., to 3½ x 3½ vert. engine, new.
2½ K.W. Engberg, 115 V., 725 R.P.M., to 3½ x 3½ vert. engine, new.
3½ K.W. Engberg, 115 V., 535 R.P.M., to 4½ x 4½ vert. engine, new.
37½ K.W. Westinghouse, 125 V., 300 R.P.M., to 10 x 10 Ames engine.
50 K.W. American Engine, 125 V., 285 R.P.M., to 13 x 11 American Ball engine.
100 K.W. Sturtevant, 125-250 V., 275 R.P.M., to 14 x 14 Sturtevant engine.

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15 K.W. Westinghouse, 240 V., 1400 R.P.M.
40 K.W. Fisher, 125 V., 675 R.P.M.
100 K.W. G.E., 250 V., 550 R.P.M., Type CLB.
100 K.W. G.E. Otis, 240 V., 525 R.P.M., Class 4—100—525.

60 Cycle Motors, 220 Volts

2 H.P. Bell, 2 phase, 1800 R.P.M., Squirrel cage.
2—2 H.P. G.E., 3 phase, 1200 R.P.M., Type KT, one back geared.
2—3 H.P. G.E., 2 phase, 1200 R.P.M., Type KQ.
2—3 H.P. G.E., 3 phase, 1200 R.P.M., Type KT.
3 H.P. G.E., 3 phase, 1800 R.P.M., Type KT.
20 H.P. Westinghouse, 2 phase, 1200 R.P.M., Type B.

Direct Current Motors

125 H.P. Otis, 240 V., 450 R.P.M., Compound wound double extension shaft.
125 H.P. G.E., 250 V., 500 R.P.M., Compound Type CLB.
20 H.P. Westinghouse, 230 V., 1300 R.P.M., Compound
15 H.P. G.E., 230 V., 1100 R.P.M., Type CE.
10 H.P. Northern, 220 V., 825 R.P.M.
10 H.P. Browning, 220 V., 1220 R.P.M.
10 H.P. G.E., 220 V., 1300 R.P.M.
5 H.P. G.E., 220 V., 1100 R.P.M.

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50 K.W. Westinghouse, 3 ph., 60 cy., 2300 v., to Harrisburg auto. engine.
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150 K.W. Westinghouse, 3 ph., 40 cy., 600 v., to 14" x 21" Hamilton Corliss.
500 K.W. Westinghouse, 3 ph., 60 cy., 2300 v., turbo generator sets (2).
750 K.W. General Electric, 3 ph., 40 cy., 600 v. to 20" x 48" x 36" McIntosh & S.

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300 K.W. Westinghouse, 3 ph., 60 cy., 2300 v.

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25 K.W. General Electric, 250 v.
40 K.W. Western Electric, 125 v.
60 K.W. General Electric, 125 v.
65 K.W. General Electric, 125 v.

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10 H.P. Allis-Chalmers, 110 v.
10 H.P. General Elec., 110 v.
10 H.P. Sprague (G. E.), 220 v.
15 H.P. Western Electric, 110 v.
70 H.P. Western Electric, 110 v.

A. C. Motors, 3 ph., 60 cy.

25 H.P. Westinghouse, 2300 v.
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50 H.P. Fairbanks Kerosene.
50 H.P. Fairbanks-Morse, crude oil, special electric engine (used 3 weeks).

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12" x 24" Harris.
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14" x 36" Bates (Heavy Duty)
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For 3 Phase, 60 Cycle Circuits

H.P.	R.P.M.	Volts	Type of Starter	Standard Pulley	Shipping Weight	Mfgr.
*50	900	220	Face Plate	14 x 9	2480	Allis
*50	720	220	Face Plate	16 x 10	2670	Allis
*60	900	220	Face Plate	18 x 11	2740	Allis
†75	720	440	Face Plate	22 x 13	4070	Allis
†75	900	220	Face Plate	20 x 12	3070	Allis
‡100	450	2200	Drum Type	28 x 22	6500	G. E.
†100	720	220	Face Plate	24 x 15	4200	Allis
†125	900	440	Face Plate	24 x 15	4350	Allis
†125	720	440	Face Plate	26 x 17	4650	Allis

Ready for delivery, ‡July, *Aug. 1, †Aug. 15.

60 CYCLE ROTARY CONVERTER SUBSTATION EQUIPMENT

Complete switchboard equipment for all.

One (1) 150 K.W. unit, consisting of one 150 K.W. rotary converter, 3 phase, 60 cycle, interpole, compound wound, D.C. volts 250/275, complete with 3-60 KVA, OFSC transformers, primary voltage 2300/4000.

One (1) 200 K.W. unit, consisting of one 200 K.W., rotary converter, 3 phase, 60 cycle, interpole, compound wound, D.C. volts, 250/275, complete with 3-80 KVA, OFSC transformers, primary voltage 2300/4000.

Ready for shipment August 15, 1917.

One (1) 300 K.W. unit, consisting of one 300 K.W. rotary converter, 6 phase, 60 cycle, interpole, compound wound, D.C., volts 250/275, complete with 3-125 KVA, OFSC transformers, primary voltage 2300/4000.

‡One (1) 175 K.W., 900 RPM, 3 phase, 60 cycle, 2300 volts, revolving field belt-driven generator and exciter.

‡July delivery.

WE also have available for immediate shipment, the following second-hand apparatus, which is all in excellent operating condition, and available for inspection and test.

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All in excellent condition and available for inspection under operating conditions.

One (1) 7½ K.W. direct connected steam driven exciter set, consisting of American Blower Company's vertical engine and Bullock generator, complete with all fittings.

Three (3) 75 KVA, Westinghouse, 60 cycle, OFSC, type S, transformers primary volts 2100/2200/2300, secondary volts 185/370 with 120 volt full capacity rotary starting tap. Complete with oil.

One (1) 300 K.W. Westinghouse, compound wound, 3 bearing belt-driven generator speed 435 RPM, 275 volts.

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We specialize on transformers. We offer for immediate shipment the following:

Single-phase, 2200 x 110-220 V., 60 cycles.

15—1 KVA	10—4 KVA	10—10 KVA
6—2 KVA	20—5 KVA	10—15 KVA
10—3 KVA	6—7½ KVA	4—20 KVA

Single-phase, 2200 x 110-220-440 volts, 60 cycles.

4—3 KVA	2—4 KVA	1—25 KVA

4— 5 KVA, Single-phase, 2200/4400 x 110/220 V., 60 cy.
2—200 KVA, Single-phase, 13,200/6600 x 2400 V., 60 cy.
1—100 KVA, Three-phase, 2200 x 220-440 V., 60 cy.
2— 25 KVA, Three-phase, 2200/4400 x 440 V., 60 cy.
1— 15 KVA, Three-phase, 16,500 x 110-220 V., 60 cy.
1— 10 KVA, Three-phase, 2200 x 110 V., 60 cy.
2—7½ KVA, Three-phase, 2200 x 220-440 V., 60 cy.

Deliveries on other sizes as follows:

60 cycle, 2200 volts, 1 to 25 KVA—3 to 4 weeks.
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25 cycle, 2200 volts, 1 to 25 KVA—4 to 6 weeks.
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No. P4507. 1—105-Kw., A.C., 60-cycle, 3-phase, 2300-volt Generator Set direct connected to 12"x20"x16" Ball Engine.

No. P4509. 1—200-Kw., A.C., 60-cycle, 3-phase, 2300-volt Generator Set direct connected to 18"x30"x19" Fleming 4-Valve Engine.

DIRECT CURRENT MOTORS—110 VOLTS

No.	H.P.	Make	Speed
K1321	½	Standard	1600
K1322	½	Central	1150
K1323	1	Browning	1050
K1324	1	Sprague	1200
K1325	2	Crocker-Wheeler	1700
K1326	2	Bullock	1050
K1327	3	Bullock	1650
D470	5	Triumph	925
K1328	5	Crocker-Wheeler	950
K1329	5	Bullock	1650
K1330	5	Bullock	1050
K1331	5	C. & C.	830
K1332	5	C. & C.	1025
K1333	5	Sturtevant	1200
K1334	5	Peerless	1200
K1335	6	W. E.	1200
K1336	6	C. & C.	940
K1337	7½	C. & C.	1180
K1338	7½	Crocker-Wheeler	875
K1339	7½	Westinghouse	850
K1340	7½	Peerless	800
K1341	10	Crocker-Wheeler	825
K1342	10	Western Electric	950
K1343	10	Bullock	1050
K1344	15	Peerless	1085
K1345	20	Westinghouse	1050
K1346	30	C. & C.	520
K1347	170	Crocker-Wheeler	500

DIRECT CURRENT MOTORS—220 AND 250 VOLTS

No.	H.P.	Make	Speed
D506	3	Detroit	1400
D507	5	Detroit	1700
D517	5	Detroit	1700
D475	5	General	110
D482	20	Northern	
D510	20	Detroit	1000
C684	25	W. E.	1100
C685	20	Kenny	1015

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Frank Toomey, Inc.

3 Phase, 60 Cycle Motors

200 H.P. Westinghouse type "CCL," 220-440 volt, 690 RPM.
200 H.P. Crocker-Wheeler, 220-440 volt, 600 RPM.
100 H.P. Allis-Chalmers, 2200 volt, 1200 RPM.
40 H.P. NEW General Electric, form "K," 220 volt, 900 RPM.
35 H.P. General Electric, form "K," 440 volt, 900 RPM.
37 H.P. General Electric, form "M" slip ring, 720 RPM, 440 volt.
25 H.P. General Electric, form "KT," 1200 RPM, 220 volt.
20 H.P. Westinghouse, type "CCL," 1120 RPM, 220 volt.
20 H.P. General Electric, form "M" slip ring, 900 RPM, 440 volt.
15 H.P. General Electric, form "M" slip ring, 900 RPM, 220 volt.
15 H.P. Westinghouse, "HF" slip ring, 580 RPM, 220 volt..
15 H.P. General Electric, form "M," 1200 RPM, 440 volt.
15 H.P. Crocker-Wheeler, 220 volt, 1700 RPM.
10 H.P. General Electric, 550 volt, 1200 RPM.
10 H.P. General Electric, type "CCL," 220 volt, 1700 RPM.

2 Phase, 60 Cycle Motors

125 H.P. General Electric, form "L," 220 volt, 720 RPM.
35 H.P. General Electric, form "K," 220 volt, 900 RPM.
20 H.P. Westinghouse, type "CCL," 220 volt, 1120 RPM.
15 H.P. General Electric, form "L," 220 volt, 1200 RPM.
7½ H.P. General Electric, form "K," 220 volt, 1800 RPM.

Direct Connected, Direct Current Units 110-125 volt

1—50 KW. Monarch, 110-125 volt, compound wound Generator, direct connected to a 13 x 12 Erieco horizontal automatic engine, 300 RPM.

1—50 KW. Bullock, 110-125 volt, compound wound Generator, direct connected to an Erie City Iron Works automatic engine, 290 RPM.

Alternating Current, Direct Connected Units, 25 cycle, 3 phase

1—300 KW. Westinghouse, 2200 volts, 3 phase, 25 cycle Revolving Field Alternator, direct connected to a 15-32 x 30 McIntosh & Seymour Gridiron valve engine, water cooled journals, automatic lubrication, Richardson Oil Pump for cylinder lubrication, 150 RPM, with Wheeler Condenser and Edwards vertical Vaccuum Pump, complete with Exciter and Panels.

3—250 KW. Westinghouse, 2200 volts, 3 phase, 25 cycle, Revolving Field Alternator, direct connected to a 14-28 x 30 McIntosh & Seymour horizontal cross compound side crank gridiron valve engine, water cooled journals, automatic lubrication, Richardson Oil Pumps, Wheeler Surface Condenser and Edwards vertical Vacuum Pump with Exciter and Panels.

Frank Toomey, Inc., 131 North 3rd Street, Philadelphia, Pa.

3 phase, 60 cycles

K.V.A.	Generator.	Voltage.	Speed.	Price.
270	Wghse.	2300	600	$1,450
250	Allis.	480-240	900	1,300
200	Wghse.	2300	900	1,000
180	G. E.	2300	600	1,100
125	Allis.	2300	900	850
100	W. E.	550	1200	700
50	Wghse.	220	1200	500

Power Machinery Exchange, Inc.
1 Montgomery St., Jersey City, N. J.

TURBINES
Immediate Delivery

2—400 kw. horizontal Westinghouse Parsons—2200—2—60. Can be connected for 3 phase, coupled right and left to 3000 ft. Alberger condenser. All pumping equipment and switchboard panels. Excellent condition.

GENERATOR

250-kva. brand-new Fort Wayne 240-volt, 3-phase, 60-cycle, waterwheel, latest-type Generator.

Owned and Offered by
Karl Andrén Co., 45 Oliver St., Boston, Mass.

IN STOCK
PROMPT SHIPMENT

1—175 K.W. Westinghouse Generator, 3 phase, 60 cycle, 2200 volts, 900 R.P.M., with suitable belt driven exciter.
3—150 K.W. Westinghouse D.C. Generators, 300 Volts, 250 R.P.M., direct connected to 18 x 18 Russell automatic engines.
2—150 K.W. General Electric Generators, 3 phase, 60 cycles, 220 volts, 600 R.P.M., form D, with built in exciters (make fine synchronous motors).
1—85 K.W. Allis-Chalmers Generator, single phase, 60 cycles, 900 R.P.M., 2200 volts, with belted exciter.
1—75 K.W. Fort Wayne (General Electric) Generator, 3 phase, 60 cycles, 480 volts, direct connected to 13 x 13 Russell enclosed, self-oiling automatic engine with exciter and complete switchboard.
1—30 K.W. Westinghouse Generator, 3 phase, 60 cycles, 480 volts, 1200 R.P.M., with suitable belted exciter.
1—25 H.P. NEW General Electric motor, 3 phase, 60 cycles, 220 volts, 900 R.P.M., with NEW G. E. starting compensator.
1—25 H.P. General Electric motor D.C. variable speed, 250 to 400 R.P.M., 110 volts with controller.
1—20 H.P. Richmond motor, 3 phase, 60 cycles, 220 volts, 720 R.P.M.
1—30 H.P. Westinghouse vertical motor, as above, at 1120 R.P.M.
Also many other generators, motors and electrical machinery as well as engines, boilers and power plant machinery of all kinds in stock.

THE RANDLE MACHINERY CO.
1822 Powers St., Cincinnati, Ohio

40 Cycle Generating Units
FOR SALE.

2—1000 KW. type ATB, 3 phase, 40 cycle, 580 volt 120 r.p.m., revolving field General Electric alternating current generators, each direct connected to 30x60x30—1500 HP. Russell horizontal heavy duty frame, cross compound automatic steam engine, excellent condition. Can reconnect voltage of generators meeting your specifications. Prompt shipment. Attractive low price.

National Machinery & Wrecking Co.
Electrical Department
1916 Scranton Road Cleveland, Ohio

SEARCHLIGHT SECTION

A.C. MOTORS IN STOCK—QUICK SHIPMENT

Item 802—1—250 HP., 2300 volt, 600 RPM., 3 phase, 60 cycle, General Electric, Form K, squirrel cage, complete.

Item 680—1—200 HP. (50 deg.), 440 volt, 600 RPM., 3 phase, 60 cycle, General Electric, form M, slip ring, complete (3 weeks).

Item 463—175 HP., 550 volt, 860 RPM., 3 phase, 60 cycle Allis-Chalmers, squirrel cage, complete.

Item 464—125 HP., 2200 volt, 580 RPM., 3 phase, 60 cycle, Allis-Chalmers, squirrel cage, complete (shipment, two weeks).

Item 774—1—125 HP., 440 volt, 450 RPM., 3 phase, 60 cycle, General Electric, Form K, squirrel cage, complete. Brand new.

Item 795—1—100 HP., 220/440 volt, 600 RPM., 3 phase, 60 cycle, General Electric, Form K, squirrel cage, complete.

Item 804—1—100 HP., 550 volt, 720 RPM., 3 phase, 60 cycle, General Electric, Form M, slip ring motor, complete. Brand new.

Items 756 and 757—2—75 HP., 900 RPM., 220 volt, 3 phase, 60 cycle, Westinghouse, squirrel cage induction motors, complete.

Item 704—1—75 HP., 685 RPM., 220/440 volt, 3 phase, 60 cycle, Westinghouse, type CCL, squirrel cage, complete.

Item 782—1—75 HP., 220/440 volt, 720 RPM., 3 phase, 60 cycle, General Electric, Form L, complete.

Items 759, 760, 761, 762—4—75 HP., 220/440 volt, 865 RPM., 3 phase, 60 cycle, General Electric, form M, slip ring, with new controllers and resistance for starting duty.

Item 665—50 HP., 220/440 volt, 900 RPM., 3 phase, 60 cycle, Westinghouse, squirrel cage, complete.

Item 581—50 HP., 440/220 volt, 860 RPM., 2 phase, 60 cycle, Crocker Wheeler, complete.

Items 758 and 665—2—50 HP., 220/440 volt, 900 RPM., 3 phase, 60 cycle, Westinghouse, squirrel cage type, induction motors, complete.

Item 806 and 660—2—35 HP., 220/440 volt., 900 RPM., 3 phase, 60 cycle, General Electric, Form K, squirrel cage, complete.

Item 781—1—35 HP., 550 volt, 1200 RPM., 3 phase, 60 cycle, General Electric, Form L, complete. Brand new.

Item 558—30 HP., 220/440 volt, 1200 RPM., 3 phase, 60 cycle, Westinghouse, squirrel cage, complete.

Items 753 and 754—2—25 HP., 1200 RPM., 440/220 volt, Fairbanks-Morse motor, squirrel cage type, complete.

Two—10 HP., 220 volt, 1200 RPM., 3 phase, 60 cycle, General Electric, squirrel cage; brand new, complete.

Rotary Converters

Items 644, 645—2—100 K.W., 600 volt, direct current, 370/385 volt A.C., 1200 RPM., 3 phase, 60 cycle, G. E., type TC, rotary converters, with 2300/370 volt, 3 phase, 60 cycle stepdown transformers and 3 switchboard panels for each rotary.

Note: The above rotary converters, at a small additional expense, may be rewound by us for 250-volt service.

TIFFANY, HALL & COMPANY, Inc.,

ELECTRICAL EQUIPMENT-ENGINEERS

90 WEST STREET, NEW YORK CITY. TELEPHONE : RECTOR 5163-5164

ALTERNATING CURRENT MOTORS
2 & 3 PHASE

50 h.p. G.E. type M., slip ring, 40 cycle, 400 rpm., 220 volts.
75 h.p. G.E. type M., slip ring, 60 cycle, 600 rpm., 220 volts. The above will reconnect to higher voltage.
25 h.p. G.E. 220 volts, 1200 rpm., form K.
25 h.p. G.E. 220 volts, 900 rpm., form K.
15 h.p. G.E. 220 volts, 1200 rpm., form K.
20 h.p. Fairbanks Morse 1200, type K.B.V., 220 v. New motor.
10 h.p. Westgh. 220 v., 690 rpm., type C.C.L.

DIRECT CURRENT MACHINES

55 k.w., 110 volt, type S., Westgh., 850 rpm.
50 k.w., 250 volt, type S., Westgh., 850 rpm.
40 k.w., 250 volt, G.E., 650 rpm.

We have large stock other sizes and voltages. When in the market to buy, sell or exchange, consult us.
Power hack saws, drill presses, grinders, etc.
Electric hoist, single drum.

R. SCHEINERT CO., 125 N. 3rd St., Philadelphia, Penna.

We are constantly in the market for large generating units, motors, etc.

WE MAINTAIN THE

Largest Electrical Repair Plant in the United States and Rebuild and Overhaul All Types of Electrical Apparatus

I. R. NELSON, 1 Bond Street, Newark, N. J.

For Immediate Delivery

1—75 h.p., 2-phase, 220-volt West. Squirrel cage, new.
1—75 h.p., 2-phase, 220-volt G. E. Form K, used.
3—50 h.p., 2-phase, 220-volt West. squirrel cage, new.
1—50 h.p., 2-phase, 440-volt West. squirrel cage, new.
1—50 h.p., 2-phase, 220-volt C. W., new.
1—50 h.p., 2-phase, 220-volt G. E., used.
1—60 h.p., 2-phase, 220-volt West. slip ring.
1—30 h.p., 2-phase, 220-volt West. slip ring, new
5—25 h.p., 2 & 3-phase, 220-volt Fairbanks-Morse, used.
1—90 K.W., 125-volt, D.C. C.W. generator.
1—50 h.p., 220-volt, D.C. G. E. motor.
4—110-volt, ½-ton chain hoists with speed regulator.
1—Direct connected pump, motor driven, 1200 gal. min.

Above are a few of over 1000 motors we have in stock MOTORS, DYNAMOS, ENGINES, PUMPS, ALL KINDS OF TRANSFORMERS, INSTRUMENTS, METERS, ETC.

Venino Bros. & Co.,
63 Hamilton Street, Cor. Ward, Newark, N. J.
Established 1896

SEARCHLIGHT SECTION

WE DID IT! MOTORS

AND NOW HAVE THE LARGEST STOCK IN AMERICA—EITHER WAY, BUY OR SELL

SLIP RING MOTORS

Qu.	HP.	Make	Phase	Volts	Speed
1	75	G. E.	3	220	1700
1	50	G. E.	3	2200	900
1	35	G. E.	3	220	1800
1	30	Whse.		220	1200
1	30	Whse.		220	720
1	20	Whse. HF.	3	220	690
	20	G. E.	3	220	840
1	15	Whse. HF.	2	220	850
1	15	Whse.	2	220	900
1	10	Whse.	2	220	1700
1	7½	G. E.	2	220	*900
1	2	Richmond.	3	220	690
1	¾	G. E. new.	2	220	600/1200

*With controller and resistances.

ALTERNATING CURRENT, 3-PHASE

1	150	G. E. Vert.	220	600
1	75	Whse.	220	1200
1	75	G. E.	2200	1150
1	50	G. E.	2200	1150
3	50	Whse.	220	850
1	50	G. E.	220	900
1	50	G. E.	220	1200
2	50	G. E	440	900
1	40	Whse.	220	850
1	35	G. E.	220	1800
1	35	G. E.	220	720
1	35	G. E.	220	900
2	25	G. E.	220	1200
1	25	Mech. App.	220	1200
1	25	Fbks.	220	1200
1	25	Whse.	220	860
1	20	Whse.	220	1700
1	20	Watson	220	1200
2	20	Whse.	220	690
1	20	W. E.	220	685
2	20	G. E.	220	900
1	15	G. E. 25 cy.	220	750
1	15	Watson	220	1200
1	15	W. E.	220	685
1	15	Fb. Mse. 25 cy.	220	710
1	10	G. E.	220	1700
1	10	G. E.	440	900
1	10	W. E.	220	1800
1	7½	G. E. 25 cy.	220	1500
1	7½	G. E.	220	1500
2	7½	G. E.	220	1200
1	7½	Linc. 25 cy.	220	750
4	5	G. E.	220	1700

ALTERNATING CURRENT 3-PHASE

Qu.	HP.	Make	Volts	Speed
4	4	G. E.	220	1200
14	3	G. E.	220	1700
12	3	G. E.	220	1200
4	1	Whse.	220	1700
2	½	Stand. 25 cy.	440	1400

ALTERNATING CURRENT, 2-PHASE

1	75	G. E.	220	900
1	40	Whse.	220	1120
2	35	G. E.	220	1200
1	30	Whse.	220	1120
1	30	Whse.	220	1150
2	25	G. E.	220	1200
1	20	Whse.	220	1700
4	20	G. E.	220	1200
2	15	Whse.	220	850
1	15	Whse.	220	1120
3	15	G. E.	220	1200
3	15	Whse.	220	1700
2	15	Wagner	220	1700
2	10	Whse.	220	850
3	10	G. E.	220	1200
2	10	Whse.	220	1700
1	10	G. E.	220	720
2	7½	Whse.	220	850
2	7½	Whse.	220	1200
1	7½	G. E.	220	720
1	7½	Richmond	440	1740
6	5	G. E.	220	1700
1	3	G. E.	220	450
6	3	G. E.	220	1200

ALTERNATING CURRENT, 1-PHASE

1	30	Wagner	220	1150
1	20	Wagner	110/220	900
1	20	Century	110/220	1750
1	15	Century	110/220	1150
1	15	Wagner	110/220	900
1	10	Wagner	220	1700
1	7½	Wagner	230	1750
3	5	Century	220	1700
2	5	Wagner	220	1700
8	5	G. E.	110/220	1800
1	5	Bell	110/220	1800
1	5	W. E.	220	450
1	2	Century	110/220	1700
1	1	G. E.	110	1700
32	¼	Emerson, new.	110	1750
135	½	Whse.	110	1150
142	¼	Whse.	110	1700

ALTERNATING CURRENT 1-PHASE

Qu.	HP.	Make	Volts	Speed
60	⅛	Whse.	110	1700
32	18-inch Exhaust Fans			
2	24-inch Exhaust Fans			
1	30-inch Exhaust Fan			

D. C. MOTORS AND GENERATORS, 110 VOLT

1	45 KW.	G. E.	800
1	35	C. & C.	800
1	30	Eddy	800
1	30 KW.	G. E.	720
1	20	C. W.	1000
1	15	G. E.	450
2	15	W. E.	1100
1	15	C. & C.	750
1	15	G. E.	1200
1	12	W. E.	1000
2	10	G. E.	1100
2	10	Roth 60V	900
1	8½	W. E.	1150
1	7½	Watson	1525
2	5	G. E.	1100
1	5	G. E.	1100
2	3	G. E.	1625
5	3	G. E.	1100
2	2 KW.	G. E. 50V	515
2	2	G. E.	1625
50	18-inch Exhaust Fans		
3	36-inch Exhaust Fans		
2	42-inch Exhaust Fans		

D.C. 220 VOLT

1	100	Milwaukee	550 Comp.
1	60	Sturtevant	427/495
1	55	G. E.	875
1	50	Whse.	1700
1	45	Sturtevant	612
1	40	C. & C.	750
1	35	G. E.	675
1	35	C. & C.	600
1	35	Bullock	330
1	30	G. E.	800
1	25	G. E.	635
1	25	G. E.	600
1	25	G. E.	675
1	25	G. E.	1200
1	25	G. E.	675
1	25	G. E.	875
2	20	W. E.	800

D.C. 220 VOLT

Qu.	HP.	Make	Speed
1	20	G. E.	1000
2	20	G. E.	750
2	20	G. E.	1100
1	20	Sprague	850
1	20	Allis Chlms.	600
1	15	C. & C.	1125
1	15	Whse.	1675
1	15	G. E.	1000
1	15	H. C.	700
1	10	G. E.	1100
1	10	Reliance	1400
1	10	Al. Chlms.	800
1	10	G. E.	450
1	10	Stand.	1225
3	10	C. & C.	500
1	10	G. E.	460/920
2	10	G. E.	450/900
2	10	G. E.	450/900
2	10	C. & C.	1100
1	7½	W. E.	500/1500
2	7½	C. & C.	1100
1	7½	G. E.	1500
1	7½	G. E.	500/1500
1	7½	Whse. New.	1100
3	7½	G. E.	1650
1	5	C. & C.	1100
2	5	C. & C.	1500
1	5	Roth	2200
1	3	Stand. Vert.	
10	1	R. & M. new.	400
	18-inch Exhaust Fans		
	36-inch Exhaust Fans		
	42-inch Exhaust Fans		

D.C. 500 VOLT

1	100	Whse.	700
1	30	G. E.	750
1	20	C. & C.	1120
1	20	C. & C.	1100
1	15	G. E.	1200
1	15	C. W.	1200
1	15	G. E.	1800
1	10	Stand.	1375
1	10	G. E.	650/1950
6	10	G. E.	450/900
1	7½	G. E. B. Gr.	550/1350
1	7½	G. E.	650/1900

NATHAN KLEIN & CO. ELECTRIC POWER EQUIPMENT MACHINERY **208 Centre Street, New York**

FOR SALE

New equipment never been set up

One Westinghouse E. & Mfg. Co. 140 K.V.A. 2300 volt, 3 phase, 60 cycle, 720 R.P.M. revolving field, 2 bearing water wheel, type A.C. **Generator** with stub shaft and third bearing for belt drive. One Westinghouse E. & Mfg. Co. 6 KW. 125 volt, D.C. Compound wound **exciter** 1675 R.P.M.

One Westinghouse E. & Mfg. Co. Blue Vermont Marble **switch-board** with complete set instruments, bus bars, etc., complete. **Price $1,500** f.o.b. Salt Lake City, Utah.

Address Dixie Power Co., St. George, Utah

Miscellaneous Electrical Equipment

3—250 KW. Simple Engine, Nordberg Corliss, direct connected to Crocker-Wheeler Generator Type, CCD., 250 Volts, 250 KW., 110 R.P.M.

2—Crocker-Wheeler Balancer sets, 125 Volts, 175 Amps.. 1150 R.P.M.

1—125 HP., 440 Volts, type CX Westinghouse 60 Cy. Motor, 580 R.P.M.

1—35 HP., 220 or 440 Volts, type C Westinghouse 60 Cy. Motor, 850 R.P.M.

1—30 HP., 220 or 440 Volts, type CCL Westinghouse 60 Cy. Motor, 850 R.P.M.

1—20 HP., 220 or 440 Volts, type C Westinghouse 60 Cy. Motor, 1200 R.P.M.

2—15 HP., 220 or 440 Volts, type B Fairbanks-Morse 60 Cy. Motor, 1200 R.P.M.

3—10 HP., 220 or 440 Volts, type I, General Electric 60 Cy. Motor, 1200 R.P.M.

Thomas Electric Repair Co.
69 W. Broadway, Salt Lake City, Utah

LIST OF MACHINERY FOR IMMEDIATE SHIPMENT

1—800 HP. Cochrane Feed Water Heater and Purifier. A-1 condition. Indiana shipment. F.O.B. cars, $480.00.

1—75 KW., 750 RPM. 125 V., direct current, belted type generator. Central Indiana shipment. Price $450.00.

1—Worthington 14" x 20" x 8½" x 15" outside packed plunger, Heavy Duty Pump. Compound Duplex, first class condition. F.O.B. cars Indianapolis, Ind., $685.00.

1—Worthington 16" x 8½" x 10" Duplex, first class condition. F.O.B. Indianapolis Ind., price $465.00.

1—200 KW., 250 V., Direct Current, Heavy Duty Corliss engine generating set. One 80 KW. and one 50 KW., 250 V., Tandem Compound Automatic engine sets. Price, three units F.O.B. foundations, $10,500.00.

1—110 KW., 250 V., Direct Current Allis-Chalmers Generator, direct connected to Tandem Compound, Heavy Duty Automatic engine; price F.O.B. cars, $3,000.00.

1—375 KVA., 80% PF., 240 V., 60 C., 2 Phase, Allis-Chalmers turbo unit, complete with jet condenser and auxiliaries.

2—300 KW., 2200 V., 60 C., 2 Phase, 150 RPM., Generators, direct connected to Heavy Duty Piston Valve Engines. Price, $3,300.00 each F.O.B. foundations.

1—600 KW., 2200 V., 60 C., 2 Phase, 100 RPM., Generator direct connected to Heavy Duty Cross Compound Engine. Units can be reconnected 3 Phase. $6,200 F.O.B. foundations.

All of above equipment in exceptionally good condition. Subject to prior sale.

ROSS POWER EQUIPMENT COMPANY,
617 Merchants Bank Building, Indianapolis, Indiana
Long Distance Telephone, Main 6417.

Complete Electric Light Plant

FOR SALE

1—30 K.W. Westinghouse belted Generator 3 phase, 60 cycle, 2300 volts, switchboard and exciter.

1—65 K.W. Westinghouse Generator, 3 phase, 60 cycle, 2300 volts, direct connected to Harrisburg Automatic Engine, switchboard and exciter.

1—110 H.P. Lombard High Pressure Boiler Pump and Heater, all piping, etc.

Practically new. Sell as a whole or in part.

K. L. Jones Machinery Co.
Atlanta, Georgia

SEARCHLIGHT SECTION

MOTORS, TRANSFORMERS, MOTOR-GENERATORS

3-PHASE, 60-CYCLE MOTORS

Qu.	HP.	Make	Volts	Type	Speed
2	½	C. W.	440		1160
1	2	F. M.	220	B	1200
2	2	G. E. NEW	220	KT	1200
11	2	G. E. NEW (special with ball bearings)	220	KT	1800
1	2	F. M.	220	B	1800
1	2¼	G. E. spec.	220	K	1800
3	3	Wstgh.-bk. grd.	220	CCL	1700
1	3	Wagner	220/440	BP	1750
10	3	G. E. NEW.	220	KT	1800
2	3	F. M.	220	B	1800
1	5	G. E.	220	KT	900
1	5	Wstgh. sl. rng. starter	550	HF	1120
2	5	F. M.	220	B	1200
2	5	Wstgh.	220	CS	1740
10	5	G. E. NEW.	220	KT	1800
1	7½–15	C. W.	230		365/1735
1	7½	Wagner	220	BP	1140
1	7½	F. M.	220	B	1800
1	7½	F. M.	220	B	1200
3	7½	Wstgh.	220	CS	1740
9	7½	G. E.	550	KT	1800
1	7½	Wstgh. vert.	220	CCL	850
2	10	G. E. NEW.	440	KT	1200
2	10	Wagner NEW	220	BW	900
5	10	R. & M. NEW	220		1120
5	10	Wstgh.	220	CS	1150
1	10	F. M.	220	B	1800
1	10	C. W.	220	Q	1800
2	15	G. E. NEW.	220	KT	1200
3	15	Triumph.	220		900
1	15	Wstgh.	220	CCL	1120
4	15	R. & M.	220		1150
2	15	G. E. NEW.	440	KT	1200
1	15	Ft. Wayne.	220	MA	1800
1	15	G. E.	220	K	1150
3	15	F. M.	220	KBV	1200
1	20	C. W.	220		1200
1	20	Wstgh.	220	CCL	1120
2	20	Triumph.	220		900
1	20	F. M.	220	B	1200
3	20	F. M.	220	KBV	900
100	20	F. M. NEW.	220	KBV	1200
1	25	Wstgh.	440	CCL	690
2	25	G. E. NEW.	220	KT	1165
11	25	Wagner	220	BP	1120
1	25	Triumph.	220		900
10	25	F. M.	220	KBV	1200
1	30	Wstgh.	220	CCL	1120
1	30	F. M.	220		900
3	35	Triumph.	220		900
1	35	Wstgh.	220	CS	1735
1	40	Wstgh.	220	CCL	850
3	40	G. E. NEW.	220	KT	1165
3	50	Triumph.	220		720
1	100	Wstgh.	2200	CCL	690
1	125	G. E. synchr., with ammortissor winding	2300	P	900
1	150	G. E.	2200	K	600
1	150	Wstgh.	440	CCL	690
1	150	G. E.	2000	K	600

3-PHASE, 25-CYCLE MOTORS

Qu.	HP.	Make	Volts	Type	Speed
1	10	Wstgh.	440	CS	750
1	10	C. W.	220		700
1	15	Wstgh.	440	CS	730
1	15	F. M.	440	B	750
1	20	G. E.	440	K	1500
3	35	Wstgh.	440	CS	730
3	50	Wstgh.	440	CS	730

2-PHASE, 60-CYCLE MOTORS

Qu.	HP.	Make	Volts	Type	Speed
1	5	Wstgh.	220	CCL	1120
	5	Wstgh.	220	CCL	1700
1	5	Fort Wayne.	220	MA	1800
6	5	R. & M. NEW	220		1700
1	5	G. E.	220		900
6	7½	G. E. NEW.	220	KQ	1200
1	7½	R. & M.	220		1150
1	7½	G. E. NEW.	220	KQ	1800
1	7½	G. E., slip-ring, no starter	220	M	900
1	10	Richmond	220		1120
2	15	R. & M. NEW	220		1750
1	15	G. E.	220	KQ	720
1	15	Wstgh.	220	F	850
3	15	R. & M. NEW	220		1150
1	15	Wagner NEW	220	BW	850
1	15	G. E.	220	KQ	720
3	15	G. E.	220		1200
1	20	Ideal.	220		850
1	20	F. M.	220	B	900
1	20	Wstgh.	220	CCL	840
1	20	G. E.	220	K	900
1	20	Wagner	220	BW	850
1	20	Wstgh., dry starter	220	C	1120
1	25	Wstgh.	220	CS	1720
2	25	Wagner NEW	220	BP	850
10	25	F. M.	220	KBV	1200
1	30	G. E. NEW.	220	KQ	1200
1	30	G. E.	220	L	900
1	30	F. M.	220		900
1	35	G. E.	220	K	600
1	40	Wagner NEW	220	BP	850
1	40	Wstgh.	220	CCL	1140
2	50	G. E. NEW.	220	KQ	865
1	50	G. E.	220	L	900

220-VOLT DIRECT CURRENT MOTORS

Qu.	HP.	Make	Type	Speed
2	10	C. W.	I	1100
2	10	C. W.	I	800
1	10	Commercial.		700
1	10	Commercial.		800
1	10	G. E. NEW.	BRF	1750
1	10	G. E. NEW.	BF	1750
1	10	G. E. compd. Elev. NEW.	BRI	275
1	10	G. E. NEW compd. elev.	BI	375
1	12	Westgh. compd.	S	800
2	13	Westgh. compd.	S	630
1	15	G. E. NEW compd. elev.	BRH	550
1	15	Westgh. to be re-wound	M	850
2	15	C. W.	I	800
3	15	G. E. NEW.	BRF	1750
1	20	G. E. NEW compd. elev.	BI	820
1	20	Electron		900
1	20	F. M.		950
1	20	G. E.	CVC	925
1	20	G. E.	CE	1070
1	20	G. E. NEW.	BI	1150
1	20	Crocker-Wheeler.	I	775
3	25	C. W.	I	750
2	25	G. E. NEW.	BRH	1750
2	25	G. E. NEW compd.	BRK	400/800
1	30	G. E.	CLB	800
1	35	G. E. NEW.	BRM	320/770
1	35	Thom.-Ryan		300/800
1	40	G. E. NEW.	BRK	900
2	40	Westgh.	S	915
1	40	G. E.	CLB	915
1	45	C. W.	D	950
1	50	Commercial.		600
1	50	G. E. NEW vert.	BV	750
2	55	G. E.	CL	900
2	60	G. E. NEW.	CO-2507	700
10	75	G. E. crane type.	GE 211	350
2	100	C. W. compd.	D	600
1	100	Westgh.	M	500
1	125	C. W. compd.	D	1100
1	125	C. W.	D	550

TRANSFORMERS

Qu.	KW.	Make	Volts
3	100	Pittsburgh NEW.	13200–440
2	110	Westgh. OISC	2200x180
3	150	Allis-Chalmers NEW	2600–2280–480
6	200	Wstgh. OISC	22000x410
4	200	Westgh. (40 cyc.)	2300–550
1	250	Westgh. (60 cyc.). OISC	13200x220–440

MOTOR GENERATORS

1—100 KW. 250 volt, 900 rpm., Crocker-Wheeler to a 125 H.P., 2300 volt 3-phase, 60 cyc., General Electric synchronous motor.

1—100 KW. 250 volt, 600 rpm., type "M" Westgh. generator and a 150 H.P., 3-phase, 60-cycle, 600 rpm. General Electric, Form "K" motor.

George Sachsenmaier & Co. 141-43-45 No. 3rd St., Phila. We carry a large line of Generators, Motors, etc. Send for Catalog

---

4000 K. W.

Frequency Changer Set

25 Cycles to 60 Cycles or vice versa. This unit is made up of two machines as follows: 25 Cycle end, 13,200 volts, 3 phase. 60 Cycle end, 11,000 volts, 3 phase. Excitation both ends, 125 volts. Speed, 300 r.p.m. Complete with field rheostats, but without exciter or starting compensators. Unit complete with base, four bearings and coupling between the two machines. Unit was built in 1908 by General Electric Company and operated until 1911.

Immediate delivery.

Sierra & San Francisco Power Co.
58 Sutter Street, San Francisco, Cal.

NEW ELECTRICAL EQUIPMENT

The following Westinghouse D.C. equipment, purchased new in 1908, never used and carefully preserved, ready for immediate shipment:

250 KW. Generator—250 V. 1000 A.—580 R.P.M. —36-in. pulley.
20 K.W. Generator—250 V.—80 A.—1025 R.P.M. 10-in. pulley.
125 H.P. Motor—220 V.—1200 R.P.M.—Spare armature—no pulley.
40 H.P. Motor—shunt wound—220 V.—490 R. P.M.—12-in. pulley.
20 H.P. Motor—shunt wound—220 V.—760 R. P.M.—7-in. pulley.
15 H.P. Motor—shunt wound—220 V.—875 R. P.M.—9-in. pulley.
13 H.P. Motor—shunt wound—220 V.—800 R. P.M.—no pulley.
10 H.P. Motor—shunt wound—220 V.—1025 R. P.M.—no pulley.
Switchboard for above equipment and lighting circuit.

Prefer selling entire outfit in one lot to consumer. Jobbers and middlemen need not apply. Address P. O. Box 289, Rockland, Michigan, and make definite price offer.

FOR SALE

2200 K.W. 500 volt, D.C.

GENERATOR

Available for immediate delivery

G.E. type MP., 18-2200-140 r.p.m., form H 500 volt, 4400 ampere D.C. generator, suitable for direct connection to water wheel. The armature of this machine has just recently been entirely rewound with Mica asbestos insulated coils and the commutator rebuilt. This machine can be rebuilt into a 25 cycle, 525 volt rotary converter and re-rated at 4000 K.W.

ALUMINUM COMPANY OF AMERICA
Massena, N. Y.

FOR SALE

Switchboards—Transformers—Regulators

1—3000 V., Type F, A.C. Voltmeter.
1—300 V., Type GM, A. C. Voltmeter.
4—Panels controlling 8—350 K.W. Transformers. Equipment per panel:
2—300 amp., Type F, Ammeters.
1—1200 K.W. polyphase indicating Wattmeters.
2—Single phase, Type C, Wattmeters.
4—2400 Amp., 250 V., S.P.D.T., Type D, Knife Switches.
1—300 Amp., 2200 V., 4 O.S.T., Oil circuit breaker.
12—200 Amp., 3300 V., S.P.S.T., disconnecting Switches
8—350 K.V.A. Scott connected, 3 ph., 2300 V. to 2 ph., 240 V., 60 cy., air-cooled Transformers.
2—American Blower Co., 36" blowers, direct connected to 2—2.7 H.P., 240 V., 2 ph., 60 cyc. motors, 525 R.P.M.
10—Panels, each controlling 2—300 K.W., 60 cyc., single ph. feeders, complete with switches, ammeters, voltmeter, and
19—1200 amp., 250 V., oil circuit breakers.
19—Potential feeder Regulators, motor operated, designed for 800 amp., 240 V., Circuits.
All made by Westinghouse Electric & Manufacturing Co.

LOUISVILLE GAS & ELECTRIC CO., Inc.
Louisville, Ky.

SEARCHLIGHT SECTION

FOR SALE

1—Direct-connected D. C. Railway Unit consisting of Westinghouse 325 K.W. Railway Generator (B rating) at 550 volts and 100 r.p.m., direct-connected to Nordberg Tandem Compound Corliss Engine 16" x 32" x 42".

Purchaser can inspect unit in operation and obtain prompt delivery.

LYCOMING EDISON CO.
Williamsport, Pa.

Direct Current Motors Used

HP.	Speed	Volts	Make	Cleveland	H.P.	Speed	Volts	Make	Cleveland
1/10	2400	115	Peerless	1	5	1490	110	Peerless	1
1/12	1500	110	R. & M.	1	5	1470	110	Peerless	1
1/7	3000	115	R. & M.	1	5	1375	110	R. & M.	1
1/6	1800	110	Bodine	1	5	1300	110	Lincoln	1
1/6	1100	110	Ft. Wayne	1	5	480/1920	110	Reliance	1
1/5	1800	110	Western	1	6	560	110	Card	1
1/4	1700	110	G.E.	1	7½	1650	115	Jenny	1
1/2	1720	110	Peerless	1	7½	1480	110	Peerless	1
1	2450	110	Peerless	1	7½	1460	110	Peerless	1
1	2000	115	G.E.	1	7½	1150	110	Reliance	1
1	1275	110	Sprague	1	10	1325	110	Westg.	1
2	1900	115	G.E.	1	10	850	110	Jantz-Leist	2
3	1770	110	Peerless	1	10	750	110	Jantz-Leist	1
3	1170	115	Sprague	1	10	700	115	G.E.	1
3	1150	110	Sprague	1	10	300/1000	110	Jantz-Leist	1
3½	350	110	Reliance	1	15	1150	110	Reliance	1
5	1800	115	Westg.	1	15	850	125	Triumph	1
5	1560	110	Peerless	1	20	750	110	Jantz-Leist	1
5	1525	110	Peerless	1	Special prices on these motors.				

THE ELLIOTT ELECTRIC CO.
328 Champlain Ave., Cleveland, Ohio

R. S. Baldwin Co.

New and Used
Electrical—**MACHINERY**—Steam
Machine Tools
Extensive Export Experience
39 Cortlandt St., New York

SLOW SPEED MOTORS—GENERATORS

We own and can ship promptly the following DIEHL MOTORS: 230 v. D.C., 90 h.p. at 460 r.p.m., 75 h.p. at 340 r.p.m., 50 h.p. at 200 r.p.m., 7½ h.p. at 100 r.p.m., also 60 and 65 h.p. Northern at 460 and 500 r.p.m.
Generating Set: 160 K.W., Northern, 240 v., D.C., 420 r.p.m., belted to 16 x 42 Allis H.D. Corliss engine. 50 K.W. G.E. A.C. generator, 60 cycle, 600 v., 1200 r.p.m..
We handle power plant equipment of all kinds.

HUGH W. DYAR
140 S. Dearborn Street, Chicago, Ill.

IMMEDIATE DELIVERY

Two 400 K. W. Rotary Converters

P. P. S., 25 cycles, A. C. volt 335, D. C. volt 550, with transformers. 13,200 volt primary, 335 secondary.

Sun Power Equipment Co.
Commercial Trust Bldg., Philadelphia, Pa.

50 H. P. 2200 Volt Motor

1—50 hp. Motor, 900 r.p.m., 2200 volt, 60 cycle, 3 phase General Electric slip ring new motor in original crate, complete with drum controller and resistance. No pulley or base. $950 net f.o.b. Michigan delivery.

R. J. KIRCHNER, 823 Dime Bank Bldg., Detroit, Mich.

FOR SALE—**BARGAIN**

300 K.W. General Electric Generator

2 phase, 60 cycle, 2300 volts, type AQB, 65 amperes, 450 R.P.M., revolving field, complete with sliding base and pulley and direct connected exciter. In first class condition and ready for immediate delivery.

HARRY E. SALZBERG & COMPANY, 30 Church St., New York City

MOTORS - DYNAMOS

Write us what you want to buy or sell

SCHWARTZ & LAND
207 Centre Street **New York**

BRAND NEW MOTORS
(In Original Crates)
Century Single Phase

40, 50 and 60 Cycles Quantity	HP.	RPM.	104/208 Volts Price Each
375	¼	1150	$35.00
88	½	1750	45.00

Liberal Discount to Dealers in Quantities

The Fuerst-Friedman Company
Dealers Electrical Machinery
831-833-835 West St., Cleveland, O.

THE SEARCHLIGHT SECTION

will locate the { Man you want / Position you want / Equipment you want

62

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FOR SALE REASONABLE
4000 ft. 5/16" Flexible Conduit.
2000 ft. 1" Flexible Conduit.
4000 ft. No. 8 O.C. Duplex.
2000 4½" sq. Bossert outlet boxes, ½ K.O. 2" deep.
400 ft. No. 12 conductor elevator bell cable.
Starobin Electrical Supply Co.
101 Fourth Ave., New York, N. Y.

DIESEL ENGINE DRIVEN ELECTRICAL POWER PLANTS
2—Units—120 H.P. each 3 cylinder vertical with 250-500 V. Generators. Brand new, complete in every respect.
1—Unit—175 H.P., 3 cylinder, vertical, direct connected to 3 phase, 60 cycle Alternator used a month, guaranteed in perfect condition.
SOUTHWESTERN WRECKING COMPANY.
El Paso, Texas.

FOR SALE
One 25 K.W. 125 volt.
One 40 K.W. 125 volt.
Direct Connected Units.
Warren B. Lewis,
740 Grosvenor Bldg., Providence, R. I.

FOR SALE
One good second-hand, 60 K.W., single phase, 2300 volt.
Alternator
Complete with 2¼ K. W. exciter, switchboard and instruments.
Senatobia Electric Light & Water Plant
Senatobia, Miss.

FOR SALE
One Browning Overhead Electric Traveling Crane
40-ft. span, 30-ton capacity, 5-ton auxiliary hoist, 230-volt motors. In first-class condition and for immediate delivery. Can be seen at
NATIONAL FOUNDRY COMPANY
Erie, Pa.

A. C. Units
2—100 Kw. G. E.-Curtis A.C. Turbo Units, 2200-440-220 Volts, 3 Phase, 60 Cycles, 3600 Rev., with exciters, perfect condition, available immediately. 1 Condensing, 1 non-condensing.
250 Kw. Westinghouse, 2200 Volts, 3 Phase, 60 Cycles, 150 R.P.M., latest type, A.C. Generator, Direct Connected to an 18 x 36 Heavy Duty Latest Type Corliss Engine, with Switchboard and Exciter.
250 Kw., 2200 Volt Westg., 3 Ph., 60 Cycles, A.C. Generator, 240 Rev., Revolving Field, direct connected to 18 & 30x16 Westg. Vert. Cross Comp. Engine. Exciter and Switchboard. Perfect condition. $2,900.
H. R. WILSON MACHINERY CO.
Federal Reserve Bank Bldg.
ST. LOUIS, MO.

Brand New Generating Units
For immediate shipment—One 100 k.w. 125-250 volts, 3 wire **General Electric** direct current **generator,** speed 235, and directly connected to **Poppet Valve Uniflow engine.** Steam pressure 150 pounds and up. Switchboard included.
For shipment within 30 days—One 180 k.v.a. 60 cycle, 3 phase, 2300 volts **Western Electric Alternator,** 200 revolutions, directly connected to Non-releasing **Corliss engine.** Belted exciter included.
Also—One 450 k.v.a. 60 cycles, 3 phase, 2300 volts **General Electric Alternator,** 150 revolutions, directly connected to Non-releasing **Corliss engine.** Belted exciter included.
We also have 312 k.v.a. and 575 k.v.a. units coming through.
H. A. & G. X. Chuse, Mattoon, Ill.

FOR SALE
75 kw., 6 pole, 275 r.p.m., 220 volt. D.C.
GENERATOR
Fort Wayne, direct-connected outfit only, less engine.
Bardin Bros. Elec. & Power Ex.
1023 Washington Ave., So., Minneapolis, Minn.

MOTORS 2 SELL
4—2 and 2 hp., single phase.
2—15 hp., 2 phase. All cheap.
B. BESUNDER **Tannersville, N. Y.**

Boilers and Engines
For Sale
All the steam equipment consisting of
Boilers, Engines and Pumps
will be ready to release in 60 days. Now in operation. Detailed information on request.
LOUISVILLE LIGHT & WATER CO.
Louisville, Ill.

FOR SALE
New Turbo Generator Set
Change in plans makes available for immediate delivery 80 Horsepower **Kerr Economy Steam Turbine** Direct Connected to 3 wire, 125-250 volt, **General Electric Generator.** Complete specifications and price on request.
PIEDMONT ELECTRIC COMPANY
Asheville, N. C.

New Rectifier and Equipment
1—Gen. Elec. Mercury *Arc Rectifier,* 50 light unit, 2200 volt Primary. 4 amp. 4500 line voltage Secondary, lightning arrester, switchboard panel, ammeter and switch, two new rectifier tubes.
25—Gen. Elec. 4 amp. Series direct *luminous arcs* with repair parts. Price $800. F.o.b. Lehighton, Pa. Delivery immediate.
LEHIGHTON ELEC. LT. & POWER CO.
Lehighton, Pa.

WANTED
150 Kilowatt
Rotary Convertor
or
Motor Generator Set
250 Volts D. C. A. C. Circuit, 3 Phase, 60 Cycle. Switchboard for above. Haulage Locomotive, 250 Volts. Two short wall machines 250 Volts. Room 1029, 120 Broadway, New York.

WANTED
A second-hand
Electro Plating Generator
10-12 volts, 1000-1500 amps., in good condition. Must have carbon or wire gauze brushes.
D & W FUSE CO., Providence, R. I.

WANTED
a 300 h.p., 2200 volt, 3 phase, 60 cycle, 600 RPM, constant speed, slip ring type, 3 bearing,
INDUCTION MOTOR
Give full description, price and delivery.
COURTER ELECTRIC COMPANY
Fort Plain, N. Y.

Surplus Stock WANTED
We are cash buyers of Surplus Stocks in the line of
Wires
Cables
Cords
Conduit
Conduit Boxes
And all kinds of
Electrical Fittings and
Bell Material.
Write, telephone or wire us
STAROBIN ELECTRICAL SUPPLY CO.
101 Fourth Ave., New York

SEARCHLIGHT SECTION

FOR SALE

For Sale

1 L.W. Pond 36" Lathe 14' bed power crossfeed
1 Pratt Whitney 16" Lathe, taper attachment
1 Steptoe 17" Shaper, crank gear
1 Power Hack saw, cap. 5 in.
1 Barnes 21" Drill Press
1 Five-ton Forming Press
Engine Shaftings, Pulleys
All in first-class condition. Can be seen in operation. At a bargain.
R. Lebow, Lima, Ohio

Filtration System for Sale

One New York Sectional Wash Pressure Filter made by the New York Continental Jewell Filtration Company, inside diameter 50 inches; together with full equipment for operating same, consisting of Wagner Electric Company Single-Phase Motor; W. & B. Douglass Pump; Rensselaer Mfg. Company Valves, Electric Switch, etc., all in good condition. The Henry C. Long Asylum, P. O. Box 32, Lancaster, Pa.

Lamps for Sale

6—40 C.P., 40 Amp. Mazda Street Series Lamps.
4—80 C.P., 40 Amp. Mazda Street Series Lamps.
5—250 C.P., 40 Amp. Mazda Street Series Lamps.
Make offer.
Box 177, Lambertville, N. J.

220 Volt D.C. Equipment

2—¼ h.p. shunt motors $18 ea. One ¼ h.p. C-H speed controller $5. Two GE type C-6 2-wire 10 amp. watt-meters, new, $13.50 ea. About 100 lbs. No. 8 and 10 T. B. W. P. 30c. lb. Several 250 volt fused panel switches 40c. ea. L. C. Peterman, Groveport, Ohio.

D.C. Motor and Generator

For Sale at Bargain Price: A Fairbanks Morse 150 H.P., 600 RPM, 115 V., D.C., compound wound motor complete and in excellent condition. Can also be used as generator rated about 120 K.W., 700 RPM. Also have other sizes.
V. M. Nussbaum & Co., Ft. Wayne, Ind.

Marine Set

1—20 K.W. General Electric dynamo, 110 volts, connected to upright steam engine. Geo. Bender, 122 Centre St., New York, N. Y.

Engine and Generator for Sale

One 12 in. by 14 in. Chandler & Taylor steam engine, 272 r.p.m., 5 ft. flywheel. Also 25 K.W., 3 phase, 60 cycle, 120 volt, Fort Wayne generator. Both in first class condition and can be shipped immediately. M. P. V. Co., Flat River, Mo.

Water Power for Sale

For sale—Developed water power complete with masonry dam, building and water wheels; about 250 water H.P. during low water; 30 miles from Indianapolis; three quarter from center of city of 2200. F. S., 1006 (Ill.), Elec. World, Chicago.

Equipment for Sale

1—Sprague D.C. Type "D" Generator. 10 kw., 1125 r.p.m., 40 amp., 125-250 volt, panel board containing the following equipment:
3 switches, 2 pole, 50 amp.
3 switches, 3 pole, 100 amp.
2 switches, 2 pole, 100 amp.
1 switch, 5 pole, 100 amp.
2 circuit breakers.
1 field rheostat.
1 Weston voltmeter and 2 Weston ammeters.
1 8 hp. Fairbanks Gasoline Engine.
1 15 hp. DeLaval Oil Engine.
Above material all in first class condition, and can be bought at sacrifice for a quick sale.
Philadelphia Suburban Gas & Electric Co., Jenkintown, Penn.

FOR SALE

Motor for Sale

1—10 H.P. Direct Current Motor, G. E. Co., 230 Volt, 1375 RPM.
Make us an offer.
N. C. Public Service Co., Greensboro, N. C.

Wagner Motor for Sale

5 hp. 110 volt, A.C.; also 1, 3 and 5 hp., 3 phase motors for immediate delivery. 436 Main St., West End, Pittsburgh, Pa.

50 Kw. Alternators

Revolving field type, 60 cycle, 2300, 550 or 230 volts, 2 and 3 phase, Crocker Wheeler and Fort Wayne makes. Geo. Bender, 122 Centre St., New York, N. Y.

Engine and Generator for Sale

American Ball 13 x 12 engine direct connected to 75 kw., 2300 volt, 60 cycle, 3 phase, 276 r.p.m., G. E., A.C. generator. Exciter direct connected. Practically new. Immediate delivery. The Union Company of Omaha, First National Bank Bldg., Omaha, Neb.

Hydro Turbo Generator for Sale

We have for sale 1—500 HP. Sampson Turbine with 250 KW. Allis-Chalmers Alternator. If interested, communicate with A. H. Cox & Co., 309 First Ave. So., Seattle, Washington.

Electric Plant for Sale

On basis of 2½ times the gross earnings of $8,000. Other towns can be connected. Water power service lines 15 miles distant. F. S., 825 (Wis.), Elec. World, Chicago.

Generator for Sale

One type ATI, 900 kva., 6600 volts, 3 phase, 25 cycle General Electric generator, with one type MPC, D.C. exciter. New, never installed. Address F. S., 814 (N. Y.), Elec. World, N. Y. C.

New Copper Wire for Sale

4250 ft. No. 4/0, B & S gage, stranded, hard drawn, bare copper wire, on original reel. Never uncoiled. Immediate delivery. F. S., 626 (N. Y.), Elec. World, N. Y. C.

Vertical Motors for Sale

2—50 HP. and 1—35 HP., 1800 R.P.M., 440 volt, 60 cycle, three phase General Electric vertical motors with starting compensators—in excellent condition, at bargain prices. V. M. Nussbaum & Co., Fort Wayne, Ind.

Gas Engine for Sale

One producer gas plant complete, 100 hp., Rathburn Jones Engine, Smith producer. Also 100 hp. distillate and 150 hp. distillate engines and a 250 hp. producer plant. Immediate delivery. A. H. Cox & Co., Inc., 309 First Ave., So., Seattle, Wash.

Motors and Generators

We carry complete line of D.C. and A.C. second-hand motors, have also several D. C. generators for sale. Write us for list and prices. Dietz Elec. Co., 211 High Ave., Cleveland, Ohio.

For Sale

2 Diehl 1½ H.P., Type G-303, 115 V., 1400 RPM.
1 Diehl 2 HP, Type G-304, 115 V., 1100 RPM.
1 Westinghouse 3 H.P., Type SK, 115 V., 1150 RPM.
1 Imperial 15 H.P., Type 20, 110 V., 930 RPM.
2 Diehl 7½ H.P., 110 V., 750 RPM.
1 Peerless 3 HP., 110 V., 1100 RPM.
1 Diehl 30 K.W. Gen., Type G-312, 120 V., 1075 RPM.
1 Westinghouse 20 K.W., 120 V., 1100 RPM.
1 switchboard, has Weston 9-volt meter, 120 V., Weston ammeter, 9 in., 300 amp.
1 Main switch, 7 service switches.
All first class condition.
Naboth Vineyards, Brocton, N. Y.

FOR SALE

Motor Generator Set for Sale

75 hp., 3 phase, 60 cycle, 220 volt, 1120 r.p.m., G.E. A.C. motor direct connected to 50 kw., 125 volt G.E. D.C. interpole generator with starting panel for motor and complete switchboard for generator; also distributing board for charging electric vehicles. Very little used. Price complete $1,250 f.o.b. Chicago. Queen City Electric Co., 2944-46 W. Lake St., Chicago, Ill.

Motor for Sale

5 hp. Westinghouse, Type CCL, 220 volt, 2-phase, 60 cycle, 1700 r.p.m., excellent condition. Immediate shipment, $85. Va.—Western Power Co., Covington, Va.

BUSINESS OPPORTUNITIES

Light Plant for Sale

In town of 1500. Cash price $5,000. New oil engine equipment. Dekalb Power & Light Co., Dekalb, Texas.

Offices Available

For immediate occupancy, 1200 sq. ft. office space in The Engineering Building, Liberty St., N. Y. Unobstructed view from all sides. Ideal location for engineering company or manufacturers' representative. B. O., 963 (N. Y.), Elec. World, N. Y. C.

MISCELLANEOUS WANTS

Motors Wanted

We are in the market for several A.C. and D.C. motors, and also some plating dynamos, any size or make. Write us what you have to offer. Schwartz & Lang, 207 Centre St., New York City.

Corliss Engine Wanted

150 hp. Corliss engine for driving generator (belted). Must be A-1 condition and cheap. Hereford Light & Power Co., Hereford, Texas.

Wanted at Once

Switchboard suitable for a 35 K.V.A., 2300 volt, 3 phase generator. The Ashley Electric Light & Power Co., Ashley, Ohio.

Alternator Wanted

250 K.W.—600 (or less) R.P.M. 2300 Volt—3 Phase—60 cycle Belted Generator with exciter—furnishing complete description, price and state when shipment can be made.

Eastern Minnesota Power Company
Pine City, Minn.

WANTED

One 50 HP., 220-volt, 3-phase, 60 cycle, 900 or 720 r.p.m., variable speed,

G-E or Westinghouse Hoist Motor

complete with pulley, slide rails and control apparatus.

VIRGINIA-WESTERN POWER CO.
Clifton Forge, Va.

SEARCHLIGHT SECTION

MISCELLANEOUS WANTS

Wanted at Once

For immediate shipment any quantity of battery lead plates, sediment, scrap copper and wire, brass and all other grades of scrap material. Write us to-day for our prices. National Metal & Rubber Co., 31 India Wharf, Boston, Mass.

Complete Equipment Wanted

Complete equipment for steam plant of 50 K.W. capacity or generator and engine. Generator to be 60 cycle, 3 phase. Location in Southwest. W., 990 (Mich.), Elec. World, Chicago.

Back Volumes Wanted

Electrical World, Vol. 66 and 67 wanted. Write Observer Printing House, Charlotte, N. C.

PROPOSALS

TREASURY DEPARTMENT, SUPERvising Architect's Office, Washington, D. C., June 22, 1917.—Sealed proposals will be opened in this office at 3 p. m., July 20, 1917, for the installation complete of an electric freight elevator, etc., in the United States post office, Zanesville, Ohio, in accordance with the drawing and specification, copies of which may be had at this office in the discretion of the Supervising Architect.—JAMES A. WETMORE, Acting Supervising Architect. N. B.—Bidders are required to return the drawing and specification without marks, notes, or other mutilations. The Government frank sent to intending bidders is to be used for the return of the drawing and specification and for no other purpose.

TREASURY DEPARTMENT, SUPERvising Architect's Office, Washington, D. C., June 22, 1917.—Sealed proposals will be opened in this office at 3 p. m., July 23, 1917, for the installation complete of an elevator plant in connection with the extension to each of the following buildings: The United States post office and courthouse at East St. Louis, Ill., the United States post office and courthouse at Huntington, Va., and the United States post office and customhouse at Nashville, Tenn., in accordance with the drawings and specification, copies of which may be had at this office in the discretion of the Supervising Architect.—JAMES A. WETMORE, Acting Supervising Architect.

TREASURY DEPARTMENT, SUPERvising Architect's Office, Washington, D. C., June 20, 1917.—Sealed proposals will be opened in this office at 3 p. m., July 20, 1917, for changes in plumbing, gas piping, conduit and wiring and lighting fixtures, in the United States post office at Beaver Falls, Pa., in accordance with the specification and drawings, copies of which may be had at this office or at the office of the Custodian, Beaver Falls, Pa., in the discretion of the Supervising Architect. JAMES A. WETMORE, Acting Supervising Architect. N. B.—Bidders are required to return the specification and drawings without marks, notes, or other mutilations. The Government frank sent to intending bidders is to be used for the return of specification and drawings and for no other purpose.

POSITIONS WANTED

ARMATURE winder and general repair man, an expert on A.C. and D.C. motor and generator windings, wants position of responsibility. Address P. W., 905, Elec. World, N. Y. C.

CHIEF electrician, first class, technical and practical. Broad experience with central station and industrial companies. Will manage, lay out, installation and maintenance of electrical system. Desires change. Salary $1,500. P. W., 925 (Pa.), Elec. World, Philadelphia.

ELECTRICAL engineer, university graduate, 7 years' experience, married, 29, wants position as superintendent of electric plant or assistant with large company. At present employed. P. W., 895 (D. C.), Elec. World, N. Y. C.

POSITIONS WANTED

COMMERCIAL or operating manager, age 34, married. Excellent results in past 12 years as manager of several properties on the Pacific Coast. Doubled the net earnings of one district in 5 years. Prefer East or Middle West. Best of references. P. W., 927 (Wash.), Elec. World, San Francisco.

ELECTRICAL engineer, technical graduate with advanced degrees, 6 years' experience in construction of buildings, distribution systems, teaching and research. Can assume position of responsibility and work under great pressure. Desires position with manufacturing concern, consulting engineer or public utility. Construction, executive or research. P. W., 1021 (N. Y.), Elec. World, N. Y. C.

ELECTRICAL—Young man, 26, graduate N. Y. Electrical School, having had 5 years' practical experience, desires to connect in a line where an education is essential and where a conscientious worker can earn a future. P. W., 955 (N. Y.), Elec. World, N. Y. C.

ELECTRICIAN—15 years' experience switchboard operator in hydroelectric plants and substations and construction, maintenance and efficient handling of men. Locate anywhere. P. W., 956 (Ill.), Elec. World, Chicago.

ELECTRICIAN having 14 years' practical experience in steam plants, line construction, inside wiring, meter testing and general office work, desires position in the Middle West. Age 30. Married. 7 years at present location. $100 per month to start with. P. W. 983 (Iowa), Elec. World, Chicago.

ELECTRICIAN, 14 years as wireman, repairman, station operating. Experienced on hydro-oil engines, plant and equipment. Desires position West or Northwest. P. W., 989 (Ill.), Elec. World, Chicago.

ELECTRICAL mechanical engineer, 4 years' varied experience, desires change of position. Experimental work or development of new apparatus preferred. PW 1009 (N. Y.), Elec. World, N. Y. C.

ELECTRICAL engineer, young, married, member A. I. E. E., 7 years' broad experience, executive, can handle men, isolated plant and central station design, construction and operation; also distribution and underground transmission experience. Excellent record and references. Salary $3,600. P. W., 939 (Pa.), Elec. World, Philadelphia.

ELECTRICAL engineer having broad experience in power and lighting field desires position with operating or construction company. Familiar with station design and high tension work. Salary expected $1,800. Now employed with large utility company. P. W., 954 (N. J.), Elec. World, N. Y. C.

ENGINEER: Steam-electric, age 28, temperate, married; 10 years' practice in the engineering field; technical education, executive ability. Familiar with central station design and construction, transmission lines, light and power apparatus. At present employed, but desires to connect with public service or industrial corporation where opportunity for advancement is not limited. Am ambitious and have plenty of "pep" and my employment always holds the first mortgage on my attentions. Own engineers transit and level, also electrical instruments. Best of references from past and present employers. Available July 1st. P. W., 988 (Mo.), Elec. World, Chicago.

ENTERPRISING engineer, with exceptionally broad training and experience, offering service that will fit your requirements with utmost efficiency, desires responsible position. Send for my record and then for me. P. W., 1022 (N. Y.), Elec. World, N. Y. C.

POSITIONS WANTED

EXECUTIVE superintendent of electric light and power company thoroughly experienced, progressive, constructive, desires position with company in community of 6000 population or more. First class references from present employer. PW 1014 (Iowa) Elec. World, Chicago.

GENERAL electric test man, 27 years of age, experience in operating, power plant and substation design, and at present overseeing construction work for large operating company in Middle West. Desires change. P. W., 991 (Mich.), Elec. World, Chicago.

HYDROELECTRICAL engineer, experienced in location, design and construction, of high-head plants. Has just completed a plant in the northwest. Will go anywhere. P. W., 984 (Mont.), Elec. World, Chicago.

MAN with technical training and 15 years' practical experience in the repair and maintenance of all kinds of electrical apparatus. Last 8 years in charge of electrical repair shop employing 50 men. PW 1017 (Pa.) Elec. World, Philadelphia.

METERMAN with thorough experience on alternating and direct current and ampere-hour meters, testing, construction, repairing and installing, desires a position with opportunities for advancement. PW 1010 (Mo.), Elec. World, Chicago.

SUPERINTENDENT of light and power plant in town of 3000 to 10,000. Broad experience and technically qualified for this position. At present employed but desires change. Least salary $1,800. P. W., 801 (Neb.), Chicago, Elec. World.

SUPERINTENDENT light and water plant town 3000-5000, North or South Carolina preferred. Salary $1,200. Now employed, desires change. P. W., 968 (N. C.), Elec. World, N. Y. C.

TECHNICAL graduate, age 27, recently assistant power engineer of public utility company, but now with industrial firm, desires to return to public utility field in an engineering or executive position; 5 years' experience in gas, electric and traction accountancy, construction, operation and engineering. PW 952 (Conn.), Elec. World, N. Y. C.

YOUNG man, 23, with some technical and mechanical experience in electricity desires connection with a surveying party. Able to furnish highest credentials. PW 1018 (N. Y.) Elec. World, N. Y. C.

POSITIONS VACANT

DRAFTSMEN experienced in laying out and detailing motors. New York district. State salary and give references when replying. P. 899 (N. J.), Elec. World, N. Y. C.

DRAFTSMAN wanted, familiar with motor and dynamo design. State experience, salary wanted and date you could report for work. Position open about July 20. P., 985 (Mich.), Elec. World, Chicago.

ELECTRICIAN—Thoroughly experienced, practical man to maintain and repair induction motors in large industrial plant. Steady work and good wages for first-class man who can qualify later for position of foreman. Give age, education, experience and salary expected. P., 1003 (N. Y.), Elec. World, N. Y. C.

ELECTRICAL engineer—wanted a man with several years' experience in designing A.C. and D.C. switchboards and sub-stations. Must be able to estimate cost. In answering, state education, age and salary expected. Man with at least 10 years' experience wanted. P., 792 (Can.), Elec. World, N. Y. C.

SEARCHLIGHT SECTION

POSITIONS VACANT

EXPERIENCED meter man for care of single and polyphase meters. Plant within 200 miles of New York City. P., 959 (N. Y.), Elec. World, N. Y. C.

ELECTRICAL draftsmen for high tension station and sub-station design wanted, excellent working conditions with good future. Address P. O. Box 1902, Philadelphia, Pa.

EXPERT electrical testers, or young technical men wishing general test experience in company near New York wanted. Wages: 30c per hour up, depending on experience. P 1016 (N. J.) Elec. World, N. Y. C.

FIRST class armature winder wanted. Apply by letter to E. I. du Pont de Nemours & Co., Plant No. 1, Penn's Grove, N. J.

FOUR good inside wiremen wanted immediately at large industrial plant, Charleston, W. Va., fifty cents per hour, ten hour day. Non-Union men only, no trouble. P., 909 (W. Va.). Elec. World, Philadelphia.

GOOD opening for a bright, energetic young man of good address, who has recently graduated from one of the best technical schools in electrical engineering. Position is in office of superintendent of electrical company, where wide, practical experience can be obtained. Reply fully, stating age, salary desired, etc. P., 1005 (N. Y.), Elec. World, N. Y. C.

INSTRUCTORS, teachers, assistant professors and full professors for engineering and scientific subjects. We have quite a few openings for such parties. H. H. Harrison & Co., Teachers' Agency, Association Bldg., Chicago.

MOTOR engineer—A Chicago company has an attractive opening for an engineer who has had practical experience in designing and manufacturing small motors. Good opportunity for the right man in a growing business. Full particulars regarding your experience will be considered confidential. P., 964 (Ill.), Elec. World, Chicago.

POSITION vacant for inside wireman on tube and knob work. Must be able to read meters and willing to learn outside work if necessary. Salary $75 per month. Good opportunity. Permanent position. Prairie City Elec. Co., Prairie du Chien, Wis.

POWER house electrician near New York, must have technical training and be competent to take charge of operation and maintenance of A.C. and D.C. generators, rotaries, remote control, Terrill regulation, etc. Give age, experience and salary expected. P., 961 (N. J.), Elec. World, N. Y. C.

WANTED—By central station, southern city of forty thousand, one power plant watching engineer and one switchboard engineer. In reply give reference and state salary expected. P., 926 (Va.), Elec. World, Philadelphia.

WOULD like to get in touch with man familiar with the manufacture of flash light batteries. P., 921 (Ohio), Elec. World, Chicago.

WANTED by Electric Light Company in town of 6000 in South Western Michigan, an engineer to operate turbine and switchboard. P., 975 (Mich.), Elec. World, Chicago.

WANTED—Young man for position in Western Pennsylvania for telephone work in central office. Opportunity very good. State age, education and experience. P., 819 (Pa.), Elec. World, Phila.

POSITIONS VACANT

WANTED by manager of several electric light companies in Massachusetts, valuation and cost accountant or engineer. One who knows the various kinds of equipment used in line and plant construction and who can make maps of distribution systems. Steady work at good salary offered to right man. State fully references and experience. Apply to P., 986 (Mass.), Elec. World, N. Y. C.

YOUNG technical graduates wanted for test floor work by a large manufacturer of electrical machinery. Broad training and exceptional opportunities for qualified men. Give full particulars regarding education and practical experience in first letter. Box 911, Pittsburgh, Pa.

AGENTS AND SALESMEN

Sales Agency Wanted

For Ohio and Western Pennsylvania on live line. Exceptional service on satisfactory article. F. H. Cannon, Warren, Ohio.

Representative with New York Office

An experienced electrical engineer with New York office and commercial experience, having forign connections, desires to represent a manufacturer of electrical devices in the East. Address E. A. Barth, Hudson Terminal Bldg., New York, N. Y.

Salesman Seeks New Connection

Manufacturers of motors, electrical equipment, supplies or ball bearings, can secure the services of young electrical engineer with 14 years of technical and practical experience. Age 32. Five years with present employer. Desires change. References. S., 890 (Pa.), Elec. World, Philadelphia.

Want Representation in Chile?

A sales engineer leaving for Chile would like to get in touch with firm interested in that territory. S., 785 (Wash.), Elec. World, San Francisco.

Sales Position Wanted

Position with sales department, jobber or manufacturer wanted. Experience, excellent references. Correspondence invited. S. 1011 (S. C.), Elec. World, Philadelphia.

Recent Graduates Wanted

Electrical manufacturing company wishes to get in touch with technical graduates of 1914 or 1915 who have had practical electrical experience. There are a number of openings in the sales department. S., 21 (Ohio), Elec. World, Chicago.

Salesman Wanted

High grade electric range salesman with good acquaintance and experience in selling electric ranges to central stations. Apply by letter, giving full details. State salary expected. S., 972 (Ohio), Elec. World, Chicago.

District Sales Agent
WANTED

A prominent *manufacturer* of *electrical instruments* with old established business has opening for District Sales Agent, Chicago territory. This opening can be secured only by high-grade man known to the trade in this territory.

S973 (Ind.) Electrical World
Chicago

AGENTS AND SALESMEN

Salesman Wanted

Traveling salesman for high class specialty to the trade, either salaried or side line on commission. Jones Motrola, Inc., 29 West 35th St., New York City.

Salesman Wanted

A-1 salesman having sound knowledge of illuminating engineering wanted to sell efficient glassware in connection with lighting service. Important territories to be covered; good income and permanent position. Write, giving references and detail of previous experience. S., 999 (N. Y.), Elec. World, N. Y. C.

Manufacturer's Agent

Solicits correspondence with high-class concerns manufacturing electrical or mechanical equipment and desiring competent representation in Michigan territory. Have established office, ten years' selling experience dealing with central station, jobbing and automobile trade. R. J. Kirchner, 823 Dime Bank Building, Detroit, Michigan.

Representation for New York Territory

A well-established engineering concern in New York City would like to represent a few firms for a well-defined territory. We wish to represent only firms producing high quality goods. S., 924 (N. Y.), Elec. World, N. Y. C.

EDUCATIONAL

METERMEN WANTED to enroll for complete practical course in "Electrical Measuring Instruments and Meters." Endorsed by leading electrical men. Write for booklet, "Instruments and Meters," giving full information. Fort Wayne Correspondence School, 913 Shoaff Bldg., Fort Wayne, Ind.

BLISS ELECTRICAL SCHOOL, WASHINGTON, D. C.—Condensed course in electrical engineering, complete in one year. Thorough — practical — scientific, theoretical and applied electricity, mathematics, mechanical drawing and necessary engineering training. No superficial or non-essential studies. Actual instruction, installation and testing. For young men of energy and character. 25th year opens Sept. 26. Write for catalog. Address 129 Tacoma Ave.

ELECTRICAL ENGINEERING, PRACTICAL ONE-YEAR COURSE. Thorough training in mathematics, mechanics, applied electricity and drafting, including actual installation, operation, testing and repair of electrical machinery and testing of steam and gas engines. Also one-year course in mechanical engineering. New building and equipment. Send for catalog. Detroit Technical Institute, Detroit, Mich.

EMPLOYMENT AGENCIES

AMERICAN SERVICE COMPANY (Electrical Employment Agency), Pittsburgh, requires managers, superintendents, power engineers, operating steam, electric, hydroelectric station men, industrial plant electricians, engineers and draftsmen, metermen and testers. Employers served freely everywhere immediately.

Correspondence Service

The undersigned provides a confidential service designed to locate openings through correspondence for men earning not less than $2,500 and up to $25,000; all lines. Not an employment agency, but a constructive initiative service, covering individual negotiations. Established 1910. Complete privacy assured; present connections in no way jeopardized. Send name and address only for explanatory details. R. W. Bixby, M1 Niagara Square, Buffalo, N. Y.

1,000% Net Profit

—at least

Bay City, Mich.

We have had wonderful returns from our advertising in your Searchlight Section—showing a net profit of at least ten times the cost of the advertising. During the few months we have used space regularly, we have had inquiries from all over the country and several good export orders that we know came from our Searchlight ad.

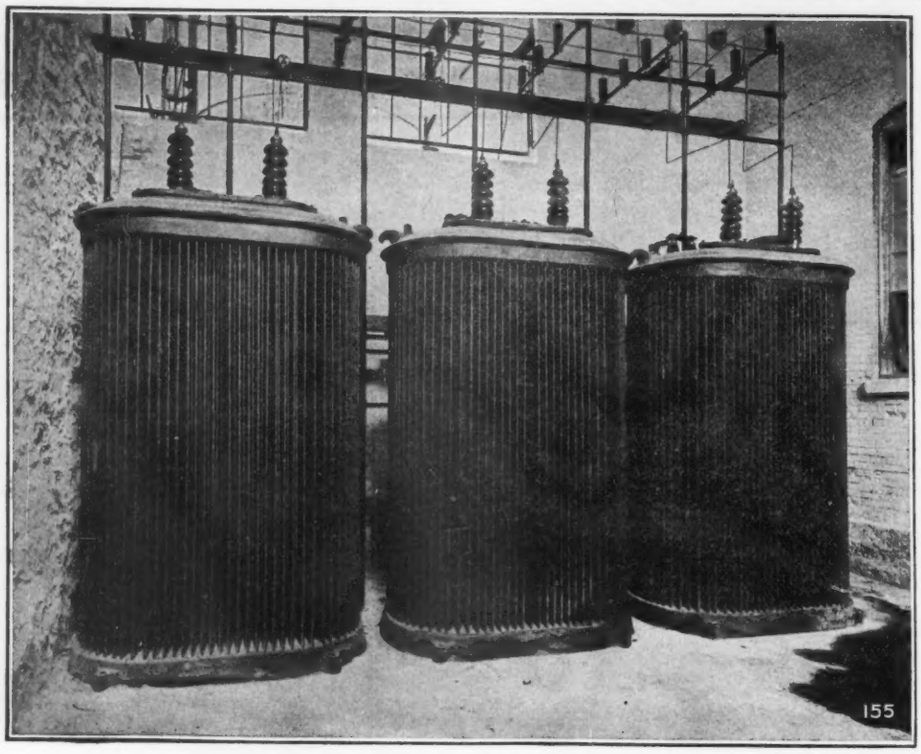
The Steam & Electrical Machinery Co.
H. M. Brooks, Pres.

Your Profit

There is profit for you in the Searchlight Section whether you use it to buy or sell used equipment, to secure agents or agencies, help or positions.

Read the foregoing Searchlight pages.

They will indicate how you can adapt the Searchlight to your particular needs with profit.



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TYPE "C"

TRANSFORMERS

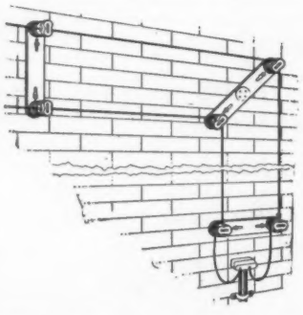
3750 KVA, 25 cycle, single phase, 33,000 to 2300 volt Outdoor Type installation.

MOLONEY Transformers are manufactured from designs that are the result of twenty years of conscientious development.

MOLONEY ELECTRIC CO.

FACTORIES: ST. LOUIS, U. S. A. and Windsor, Can.

DISTRICT OFFICES:— NEW YORK 50 CHURCH ST. CHICAGO 343 S. DEARBORN ST. SAN FRANCISCO RIALTO BLDG. 1



Above shows how, with a combination of two and three point brackets, it is possible to make practically any service connection. You don't have to carry a large variety of "Special" Brackets to meet varying conditions.

You Don't Have to Use Tie Wires With

"National" Wall Brackets

Furnished Complete With Insulators

These brackets are already in successful use on a large scale and have been adopted as standard by leading Central Stations. Descriptive Bulletin, sent on request, will show how to reduce your Distribution Costs.

Showing strain insulator construction.

National Metal Molding Co

Manufacturers of

Electrical Conduits & Fittings

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Victor

Number 5233

—the New Insulator Design

for 40,000 volts

If former designs of insulators had rendered perfectly dependable service there would have been no call for this improved type.

But engineers have called for betterment of insulators for several different voltages.

Wherefore we have designed TEN new Victors described in the supplement to "The Insulator Book."

Write for your copy as a reference book.

The Locke Insulator Mfg. Co. Victor N.Y.

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DUNCAN METERS

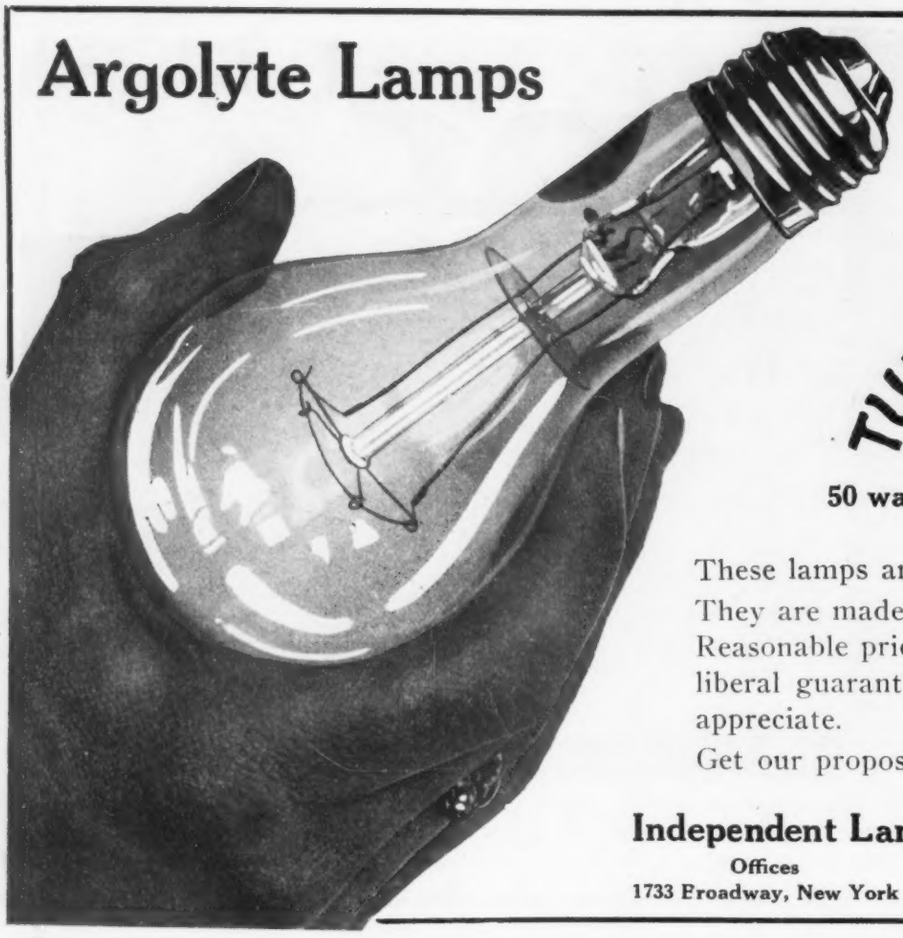
Accurate on All Loads
Highest Torque Extant
Now Shipped from Stock

DUNCAN TRANSFORMERS

High Efficiency
None Better Made

DUNCAN ELECTRIC MFG. CO., Lafayette, Ind.

Argolyte Lamps



TUNG-SOL

50 watts to 1,000 watts

These lamps are unlike others.

They are made under **our own** patents. Reasonable prices, prompt delivery and liberal guarantees are factors you will appreciate.

Get our proposition.

Independent Lamp & Wire Co., Inc.

Offices
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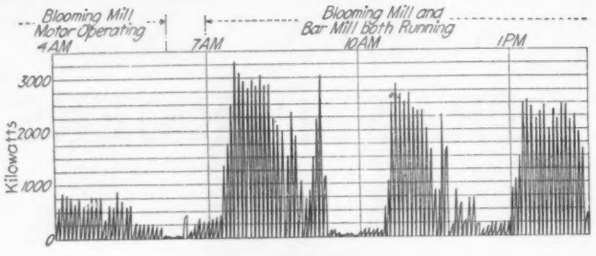


Huge and sudden variations of load

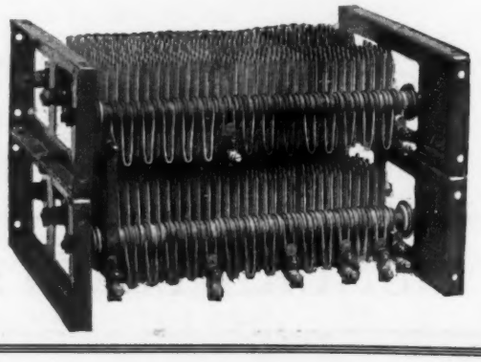
make extreme demands on electrical control apparatus. The Resistance that assures equal reliability with the other parts of the electrical system is

EMB UNBREAKABLE RESISTANCE

When such a big factor as continuous operation of a machine depends so largely on such a small factor as the resistance material—it pays well to replace cast resistance with the EMB.

The material is drawn (not cast), and is absolutely uniform in cross section. EMB Resistances are not brittle, and contain no weak spots. They are dependable.

In comparison with cast grids, EMB Resistances eliminate 95% of the joints, and cannot break down in hard service. There is the proper EMB for your work.



The Ellcon Company

50 Church Street, New York

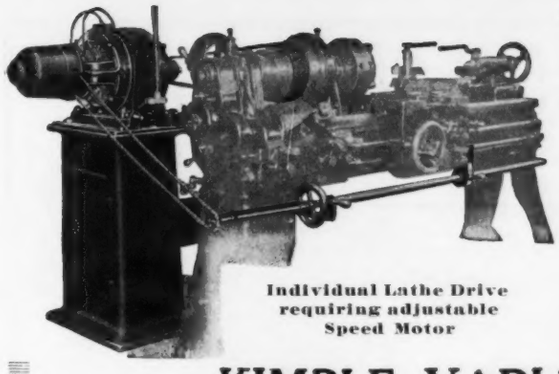
GREAT BRITAIN:
Electro-Mechanical Brake Co., Ltd., West Bromwich, England

AUSTRALIA:
J. G. Lodge & Co., 109 Pitt Street, Sydney

Combined High Voltage and Tensile Test on Suspension Insulator

The accompanying illustration shows a combined electrical and tensile test on a suspension insulator. The load applied was six thousand pounds and the electrical pressure was approximately ninety thousand volts. E. T. L. tests are the best guarantee of the ability of an insulator to meet the requirements of *your* service, or that of your customer, as the case may be. Write for information as to our facilities for serving you.

Electrical Testing Laboratories
80th St. & East End Ave., New York City



Individual Lathe Drive requiring adjustable Speed Motor

Increase Your List of Central Station "Boosters"

by starting the use of variable-speed A.C. motors on all kinds of machinery. Change factories from shaft drive to individual machine drive, on printing presses, small machine tools, special tools, etc.

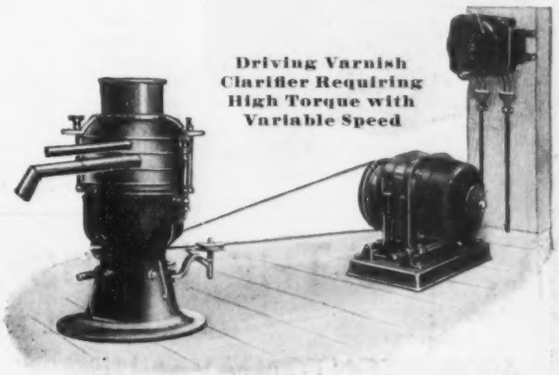
KIMBLE VARIABLE SPEED MOTORS

are exactly the type that certain manufacturers in your territory have been waiting for, because they do away with the necessity of motor-generator sets, speed-change gearing and a variety of other costly and wasteful speed regulating devices.

Absolute and unlimited speed control, high starting torque, and constant speed under varying load are assured.

Single-phase—may be applied to any phase of a two- or three-phase circuit.

Let us tell you more about it.

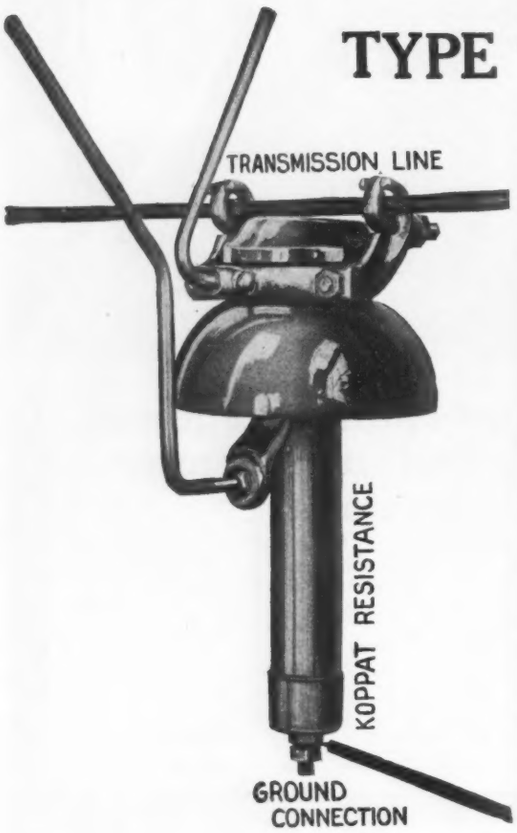


Driving Varnish Clarifier Requiring High Torque with Variable Speed

KIMBLE MOTORS

Kimbleize Your Industrial Load

KIMBLE ELECTRIC COMPANY
637 N. WESTERN AVENUE CHICAGO, ILL.



BURKE

TYPE "S" Suspension Lightning Arresters

Built for service up to 6600 volts. Thousands are in service protecting both line and transformers.

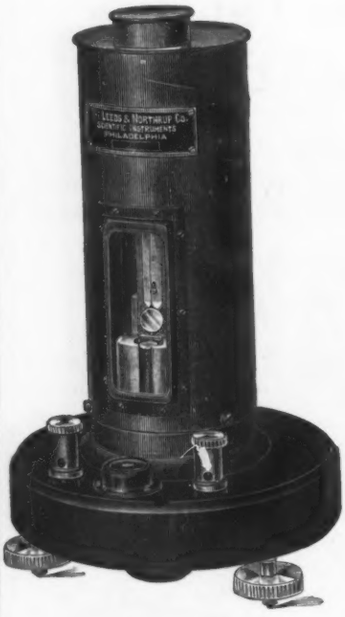
A dependable arrester of the Horn Gap type with a Koppat limiting resistance in the ground circuit

A common ground wire may be used for a number of arresters.

Not necessary to cut the line; simply clamp the arrester to the wire—no mounting required.

Write for Data

Railway & Industrial Engineering Co.
PITTSBURGH, PA.
New York Representative, No. 2 Rector Street



THE TYPE R GALVANOMETER

HIGH IN SENSITIVITY—MODERATE IN PRICE

This instrument is supplied in two types, as follows:

Type a—Resistance 10 ohms; sensitivity 2 mm. per microvolt with external critical damping resistance (50 ohms) in series; period 6 seconds.

Type b—Resistance 550 ohms; sensitivity 2000 megohms (5×10^{-10} amperes); period 6 seconds.

Note the following brief specifications:

Removable System—The entire system is easily removable to facilitate the replacing of suspensions. *Coil*—This is wound of specially selected wire, as free as possible from magnetic impurities. *Magnet*—Made of special steel, with pole pieces so shaped as to produce a radial field in order to reduce, as far as possible, the effect of foreign magnetic particles in the coil. *Suspensions*—These are of special silver strip rolled in our own factory. *Mirror*—One-half inch in diameter. *Adjustment*—Under the small cap shown on the top of the case of the galvanometer is a knurled head, by means of which the coil may be turned for zero adjustment. *Arrestment*—Under the cap mentioned above is a second knurled head, by means of which the coil may be clamped to prevent damage to its suspensions when the instrument is being moved. *Detail*—The galvanometer is inclosed in a cylindrical metal case finished in black, with a large glass window in front. The instrument is mounted upon an insulating base supported upon three leveling screws. *Setting Up*—As the air gaps are large in comparison to the size of the coil, the instrument is quite easily leveled. To assist in setting up, however, a level is mounted upon the base of the galvanometer.

Bulletin No. 250, describing this instrument, will be sent upon request.

THE LEEDS & NORTHRUP CO.

ELECTRICAL MEASURING INSTRUMENTS

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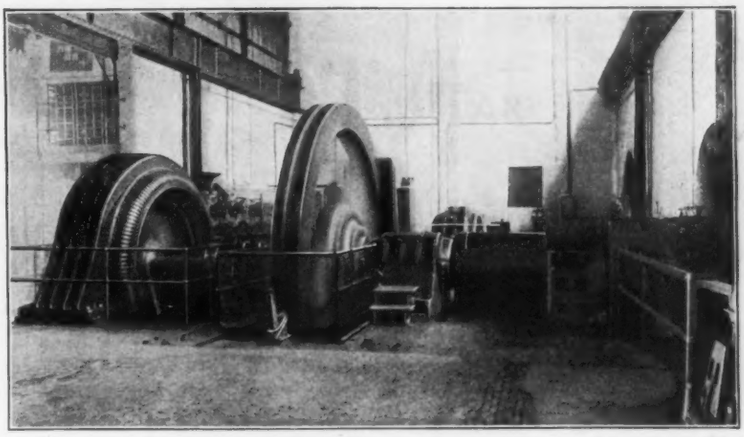
ALLIS-CHALMERS
ROLLING MILL MOTORS



Electrically Driven Wire Rod Mills

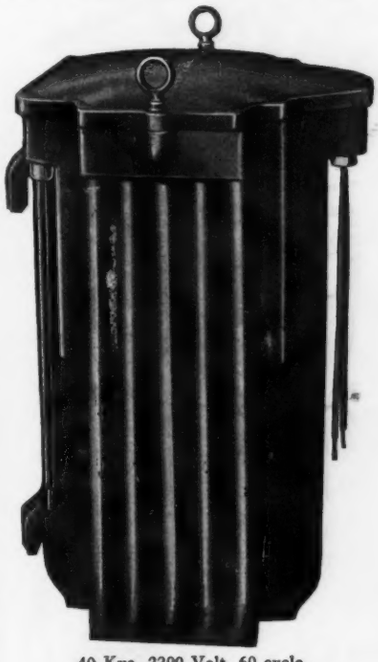
Complete Electrical Equipment
For All Types of Main Roll Drive

Heavy Duty Power and Electrical Machinery

ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

Do You Want Both Quality and Service?

THEN ORDER NOW



40 Kva. 2200 Volt, 60 cycle, Single Phase, A-B Transformer

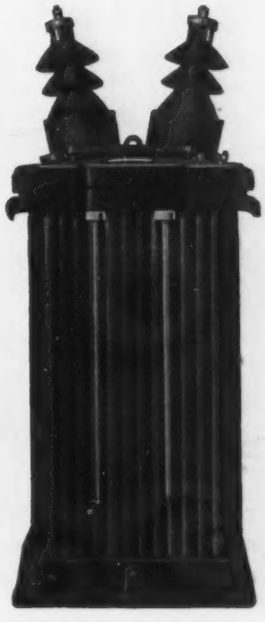
Adams-Bagnall (AB)

Distributing and Power Transformers

A-B transformers are always:

Safe in insulation;
Economical to operate;
Rugged and liberally designed;
Carefully manufactured;
Uniformly successful in operation.
Consistently a quality product backed by service.

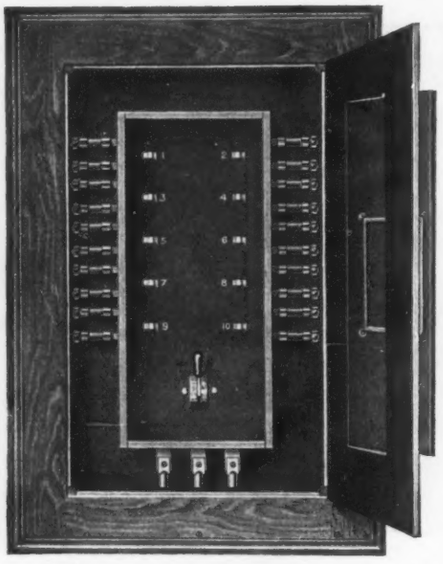
If you are not getting A-B transformers just now, be sure to buy some. They make good. Ask us.



22000 Volt, Outdoor Type, Single Phase, A-B Transformer

The Adams-Bagnall Electric Co., Cleveland, Ohio

Manufacturers of Electrical Apparatus of Merit: { Industrial, Commercial and Street Lighting, Abolites. Lighting, Power and Constant Current Transformers. Gyrofans; Oscillating Fans; Auto Electrical Accessories.



Safety Type Lighting Panel Current Carrying Parts Protected

SPRAGUE ELECTRIC
PANEL BOARDS AND CABINETS

RECOMMENDED WHERE

SAFETY SPRAGUE ELECTRIC FIRST

IS DEMANDED

SWITCHES OPERATED WITHOUT OPENING DOOR EXPOSING CURRENT CARRYING PARTS

The "on" and "off" positions of the switch are indicated by the position of the switch handle and are marked on the handle mechanism so that "on" appears when the switch is on and "off" appears when the switch is off.

All parts of this panel board are removable from the front of the board. This construction provides a minimum number of electrical joints.

Branch circuit switches are of 30 amps. 250 volts capacity, quick make and quick break tumbler type. The Main Switch is of the Brush type with double, quick break action.

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OF GENERAL ELECTRIC COMPANY

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American Telephone & Telegraph Company and Associated Companies

One Policy **One System** **Universal Service**

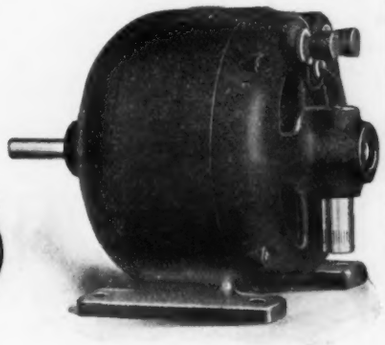
Benjamin Franklin would have left to us much more of his philosophy if his printshop had been electrically equipped. Strangely enough, his name is also connected with electrical advancement in this country.

The name Diehl is connected with electrical enterprise from the real beginning of production of electrical machinery. Motor driven machinery of every character owes a large measure of its successful operation to Diehl Motors properly applied by Diehl Engineers.

Send for Bulletins Nos. 106, 107, 601. They tell the story of Diehl Type "G" Power Motors, Diehl Type "K" Interpole Motors and Diehl Type "I" Alternating Current Polyphase Induction Motors.

Deal with

TRADE Diehl MARK



Diehl Manufacturing Co.
Elizabeth, N. J.

New York Chicago Boston Philadelphia
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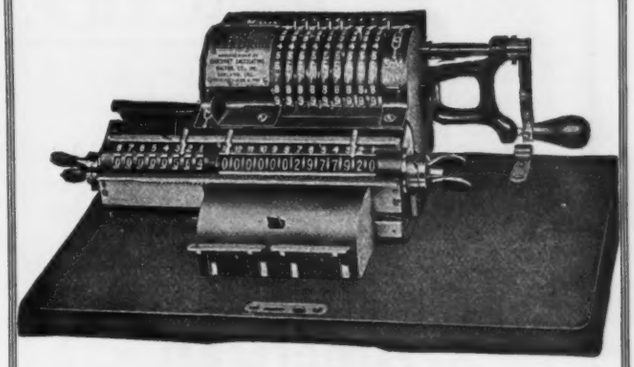
The MARCHANT CALCULATOR



The Marchant costs you nothing —— *until* it proves it will save its cost

on **your** work. If you are a dealer in Electrical Supplies, or a Central Station Manager, the point to get clear is this—

The MARCHANT is the machine that gives you EXACT (not "round") figures—and this is a great big asset when you come to figuring discounts, arriving at net expenses, compiling price books, etc., etc. We have a letter from one big dealer who tells us that he finds the Marchant more **rapid** than any other machine he ever used, and has never had a particle of trouble with it.

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This New Book Covers Water Power PRACTICE

It treats fully the essential features of the design, construction and operation of hydroelectric plants.

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It gives detailed descriptions of many typical American plants.

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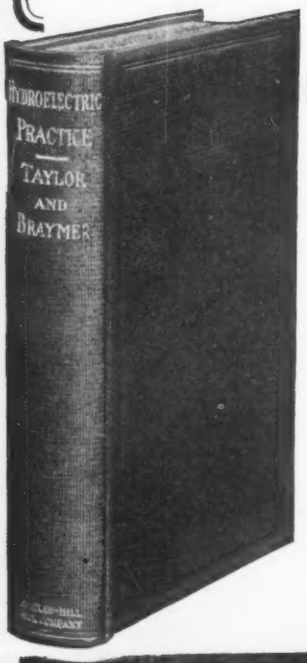

To the plant designer, constructor and operating engineer—to anyone interested in any phase of the subject—this book is almost indispensable.

That's because it covers modern American practice — completely and practically.

While it gives information of great help to the designer, it is not intended as a text book on design. But it contains material that will prove of high value as a guide in formulating, arranging and comparing plans and specifications, operating results and the like.

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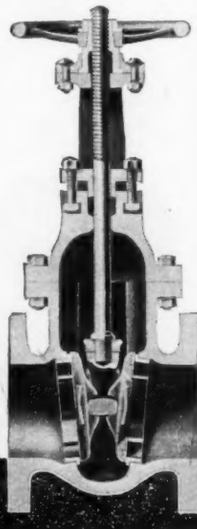
a safe valve investment

STUDY the principle of the Nelson tapered double-disc gate valve shown here.

Note the two discs with the central, spreading wedge, and the tapered seats. These form a smoothly working unit that adjusts itself to any condition within the valve.

When closing the valve the discs accurately rock into place on the seats without friction of any kind. The ports are tightly sealed even though the body may have become distorted from excessive strain or shock—a very important feature.

Why not consult our engineers regarding any of your valve problems? They are ready to serve you at any time without obligation. Write for full particulars.



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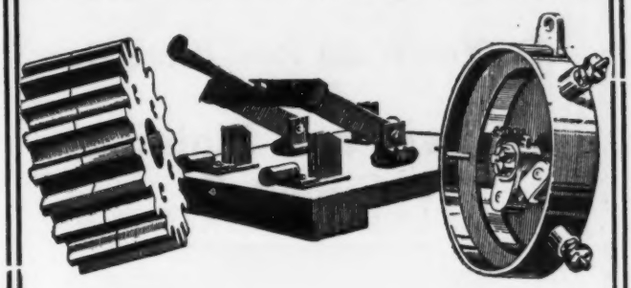
Vul-Cot Fibre

(A higher development of Vulcanized Cotton Fibre)



Vul-Cot Fibre has been called the "every purpose material" because of the large number of uses to which it may be put.

THOUSANDS of these uses are already known. And almost daily other new applications are being discovered by our engineers.

You are probably using Vul-Cot now in some form or another, yet there are quite likely hundreds of other purposes for which you could use it economically—as an insulator in your mechanical equipment—in the goods you manufacture.

Let our engineering service department aid you in finding some of these uses. Discoveries may be made that will show you how to improve the appearance of your goods—lengthen their wearing qualities—increase the efficiency of your plant and save time, labor and expense.

But first learn all about Vul-Cot Fibre. Write today for samples, prices and descriptive matter.

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Largest Manufacturers of Vulcanized Fibre in the World.
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Koravas

Before the thieving Koravas set out on a predatory expedition they decorate a goat and bring it before a favorite idol.

The idol is then asked whether the expedition will be a success.

If the goat acts good it is taken as an affirmative answer—if he acts badly they abandon the trip.

In much the same way the maker of a freak variety of carbon brushes selects a goat to try out his product.

Of course, as a matter of good business he selects a goat that won't act up bad, and so he sets out on his deadly errand.

If every carbon brush user knew that his best commutation can come only from Morganite brushes prescribed for the service there would be no field for such brush depredations—but *everyone* doesn't know this,

—and this is printed as a warning to the unwary.

The Morgan Crucible Company

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519 West 38th St., New York City

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Adjustable
Portable
Durable

Notice how it is built—not bulky but *strong*. Takes big reels as easily as smaller ones—simply turn the screw and the reel turns free. Built in two sizes covering every need.

Get information and prices.

A. L. Swett Iron Works
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"UNION" ELECTRICAL PROTECTING MATERIAL

Do You Want Real Protection
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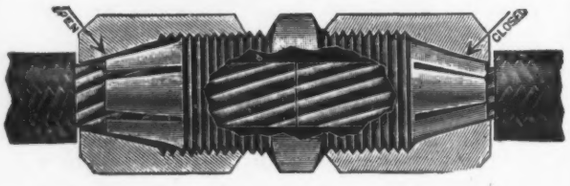
Power and Lighting Circuits?

"Union" Enclosed Fuses
Will meet your needs

Why Experiment?
It is unnecessary and sometimes costly

Write today for Catalog No. 38.

CHICAGO FUSE MFG. CO.
CHICAGO NEW YORK



Makes every splice as sound as the cable itself

Many electrical men will contend that the weakest points in their feeder cables are the *splices*. But that is because they have never used

FRANKEL CONNECTORS

The *Frankel Solderless Connector* makes every splice as sound as the cable itself. Banishes "splice-worry."

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"XDUCT"

Galvanized Conduit

Made for users who want the best. "XDUCT" is a high-grade conduit designed and made with a view to meeting all the requirements essential to precise work in electrical wiring.

Made from easy bending Spellerized Mild Steel Tube. Protected from rust by a heavy deposit of pure, non-corrosive zinc. Enameled inside with especially prepared black enamel which forms a smooth, glossy interior, through which the wires are easily fished.

Furnished in 10-foot lengths, reamed and threaded on both ends, with coupling on one end.

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2

Lightning Is Harmless

to your equipment if it is protected with Paragon Ground Cones. No matter how severe the storm, you can be certain that lightning will not injure your electric systems if you have installed these perfect grounds.

PARAGON Ground Cones

give you perfect, permanent protection. The charcoal filling keeps them always moist and the perforated copper shell affords ample discharge area.

Low in first cost, cheapest to install, and there is no cost for upkeep.

Write today for complete information.

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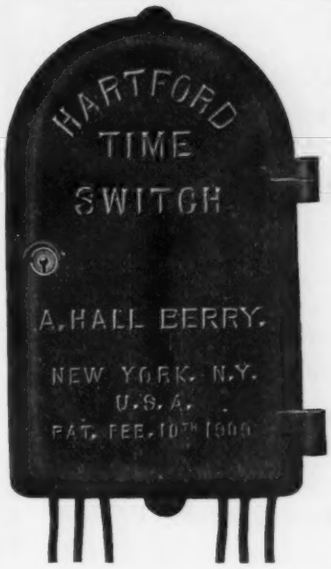


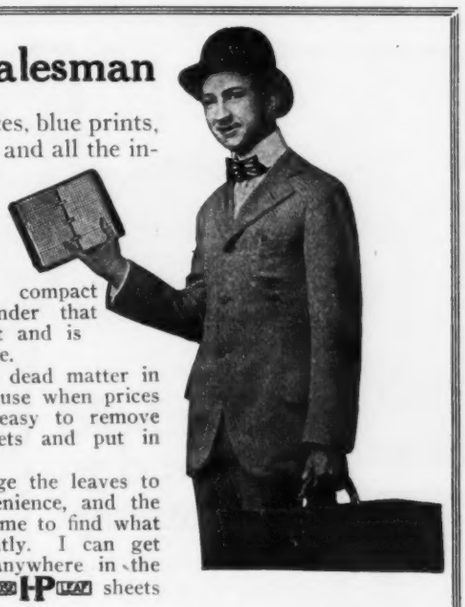
Control Electric Signs with a Hartford Time Switch

"Wind it once a week—that's all." The approved type of automatic sign control. Users of the Hartford are delighted with it. Reliable, accurate and durable to a high degree. Eliminates the human element. Lights and extinguishes the sign at proper predetermined hours. Ask your jobber's salesman.

HARTFORD TIME SWITCH CO.

A. HALL BERRY, General Sales Agent
71 & 73 Murray St., New York, N. Y.
9 So. Clinton St., Chicago

I'm a Salesman



I carry prices, blue prints, photographs, and all the information regarding my line in a LOOSE I-P LEAF Price Book—a handsome, compact loose leaf binder that fits my pocket and is always available.

There is no dead matter in this book because when prices change it is easy to remove the dead sheets and put in fresh ones.

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Largest Loose Leaf Manufacturers in the World
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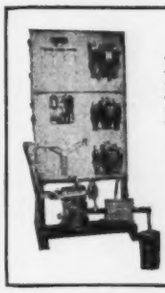
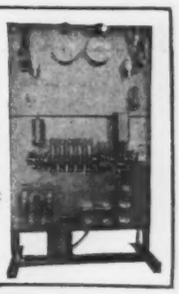
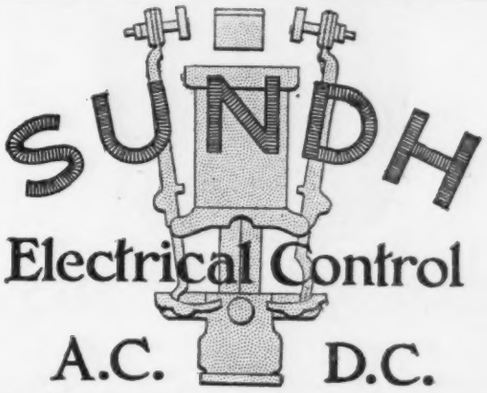


Boiler Feed Panel
For regulation of blowers furnishing forced draft.

Fire Panel
For control of fire pumps to meet requirement of the service





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A.C. D.C.

We publish leaflets on a large number of Remote Control Applications. You will very likely find in them the exact information you hope to find. Specify your control problem when you write.

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Make Oshkosh Quality Your Platform

Consumer reorders are the ballots that re-elect OSHKOSH Tools to year after year of jobber favor.

It's dollar diplomacy of the business-boosting variety that wins the loyalty of the nation-wide constituency of OSHKOSH jobbers.

Get in line for a prosperous 1917—ask your jobber about OSHKOSH Tools.

OSHKOSH MFG. CO.

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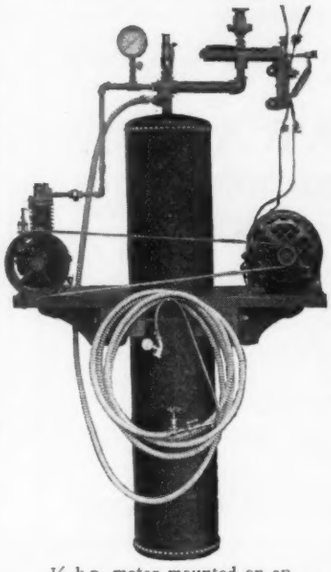
TOOLS

Always on duty—

Century

Repulsion Start Induction
SINGLE PHASE MOTORS



½ h.p. motor mounted on an air compressor

are ready to work on closing the switch. Their ability to successfully withstand the frequent starting required by coffee mills, house pumps, air compressors and heat regulators is among the reasons for their wide adoption for this class of service.

THEY KEEP A-RUNNING

CENTURY ELECTRIC COMPANY
St. Louis, U. S. A.
Sales Offices in Principal Cities

268

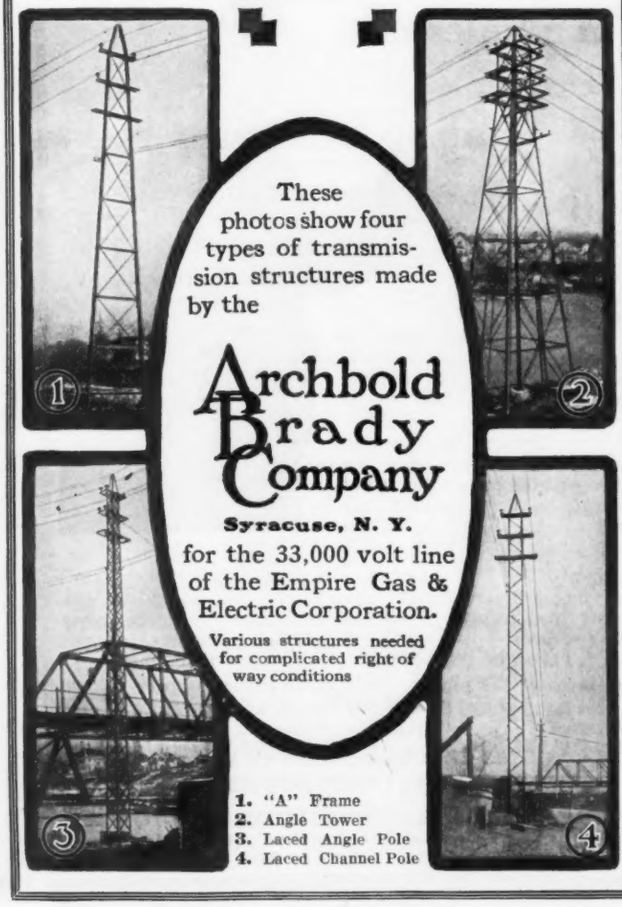
Place your thermometer on any part of the windings

PEERLESS TRANSFORMERS

Test the uniform temperature rise of Peerless Transformers *yourself*—we'll send you one for trial. Prove its efficiency in your own plant. Let *performance* not "patter"—sell you a PEERLESS. Ask us about our free trial proposition. Write NOW.

The Enterprise Electric Co.
Warren, Ohio

6


These photos show four types of transmission structures made by the
Archbold Brady Company
Syracuse, N. Y.
for the 33,000 volt line of the Empire Gas & Electric Corporation.
Various structures needed for complicated right of way conditions
1. "A" Frame
2. Angle Tower
3. Laced Angle Pole
4. Laced Channel Pole

FIELD COILS SOLENOIDS ELECTRO MAGNETS MAGNET WIRE

THE ACME WIRE COMPANY

NEW HAVEN CONNECTICUT

SHERWIN-WILLIAMS

AJAX

INSULATING VARNISH

(CLEAR AIR-DRYING)

For armatures, field and magnet-coils, mouldings, switches and fibre-sheet insulation, etc. Especially useful where baking facilities are lacking. It is a high insulator possessing extreme penetrating qualities and dries in six hours to a uniform, elastic, oil-proof, moisture-proof film.

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Rubber Covered Wire

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WIRE

For Power
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Heating and
Signal Service

AND YOU WILL OBTAIN A SUPERIOR QUALITY

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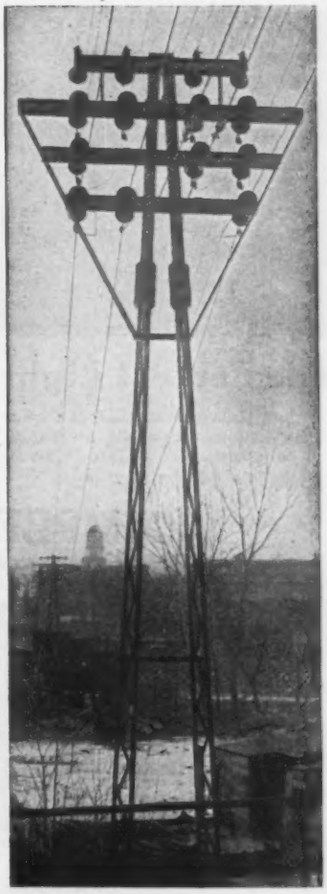
STEEL POLES

For Every Pole Purpose



Cut shows Bates A—Frame Steel Poles in use by Iowa City Light & Power Co. This line is designed to carry 18 No. 3/0 conductors on 400′ span. The poles are 45′ high.

Bates Steel Poles are in all kinds of service, power transmission, electric light and trolley poles for either span wires or trolley brackets.

Highest class and most up-to-date street railway steel pole equipment in the world. Our STEEL POLE TREATISE tells the story. Ask for it.

About 2000 tons of steel constantly on hand, immediate shipments and lowest prices.

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CHICAGO, ILL.

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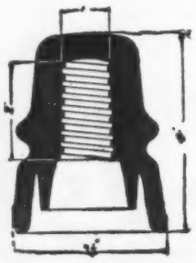
REG. U. S. PAT. OFF.

GLASS INSULATORS

Awarded gold medal at Panama Pacific International Exposition-San Francisco for low and medium voltage insulators.

The Standard for 54 Years



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Canadian Distributors:
Northern Electric Company
LIMITED

A NEW PRODUCT

for Switchboard Panels and Insulating Bases

The **logical** and **economical** material for switchboards, panel boards and insulating bases is "STONOL"—a **new product** proven

Better and Cheaper than Slate or Marble. Tested and Approved by the Underwriters' Laboratories, Inc.

"STONOL" is a natural fine grained sandstone (not a manufactured product), so treated by a chemical process that it becomes toughened and impervious to moisture. Has no metallic veins—no dry seams. Dielectric strength greater than marble.

Write for information.

The
Stone Base & Panel Co.
315-316 Schultz Bldg., Columbus, O.

The Perfect Lighting Control

—a time-switch that can be relied on absolutely—that never needs attention beyond a weekly winding—that is as durable as it is dependable. Such a time-switch is the

CAMPBELL
EIGHT DAY TIME-SWITCH

Made in five types covering all light and power control requirements of Central Stations, Jobbers, Dealers and Contractors. A money maker for the dealer who sells it and a money saver for the user. Get acquainted; write for particulars and confidential prices.

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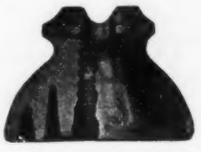
"Pittsburg"
Porcelain Insulators

The most successful high voltage insulators ever placed in operation. Install "Pittsburg" porcelain on that new line and make shutdowns a rare occurrence.



We make an insulator for every kind of service, wall and roof outlets, floor bushing, line and suspension insulators. Get in touch with our Engineering Dept.

The Pittsburg High Voltage Insulator Co.

Main Office and Factory, Derry, Penna.
Westinghouse Electric & Mfg. Company, East Pittsburgh, sole agent for United States.
Canadian General Electric Company, Toronto, Canada, sole agent for Dominion of Canada.
Harmon S. Salt, 114 Liberty Street, New York, Export Agent.

3

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the quality label for

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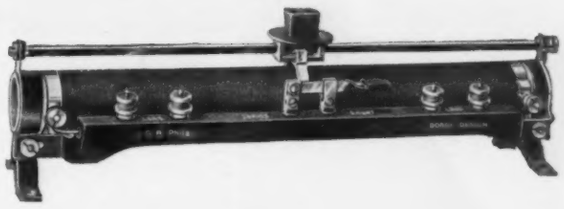

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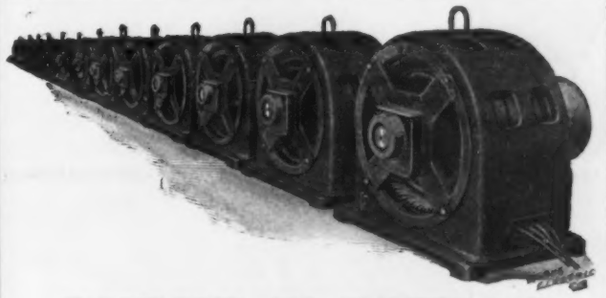

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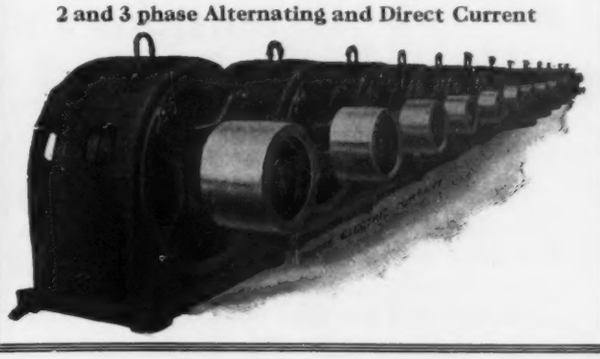

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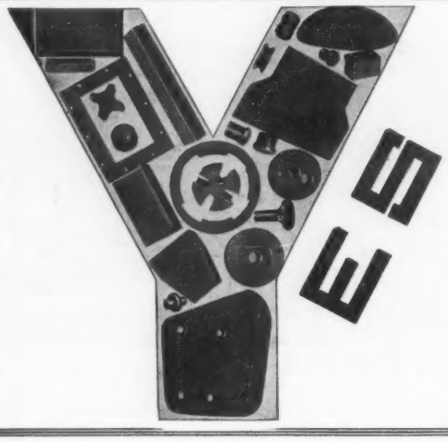

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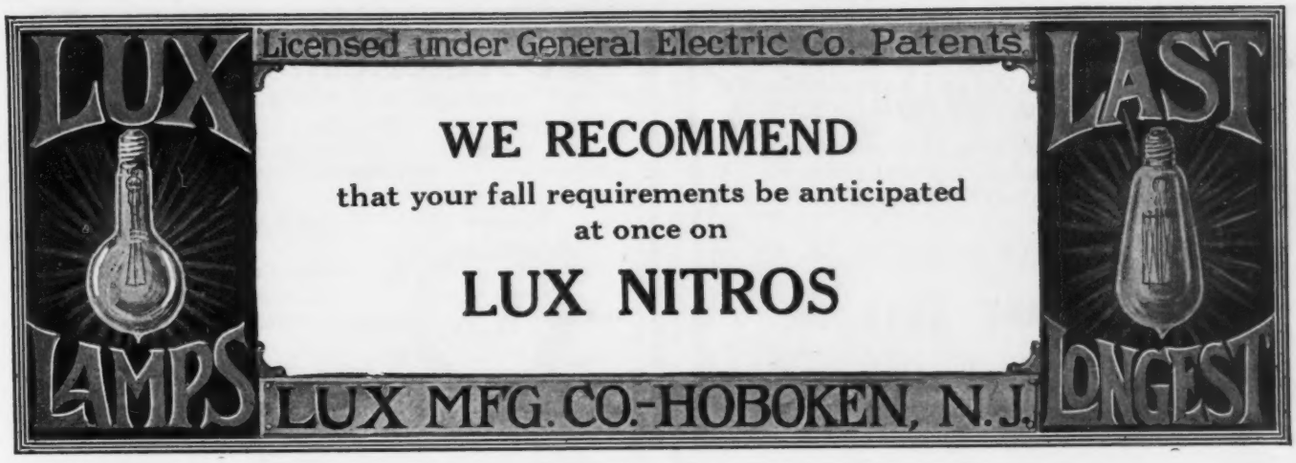

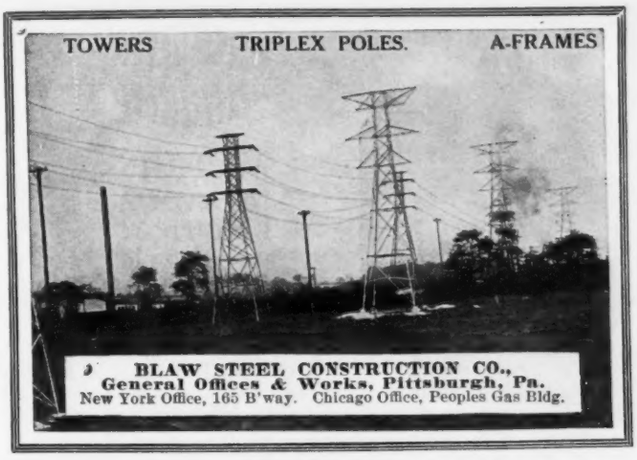
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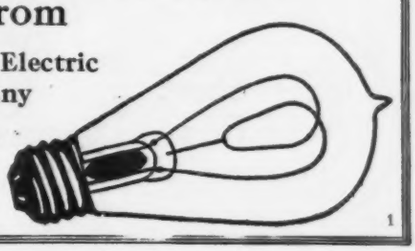

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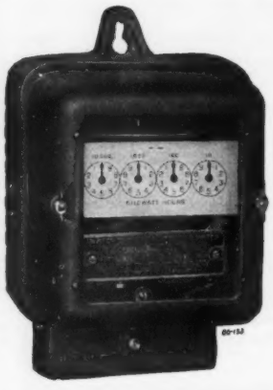

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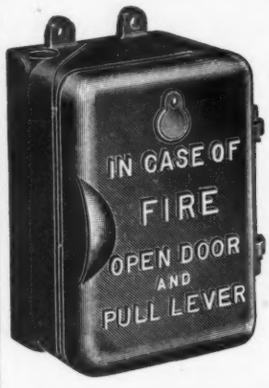

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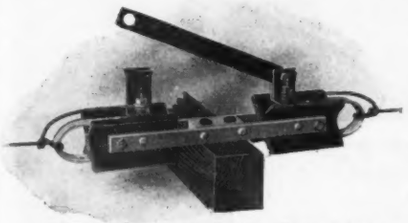

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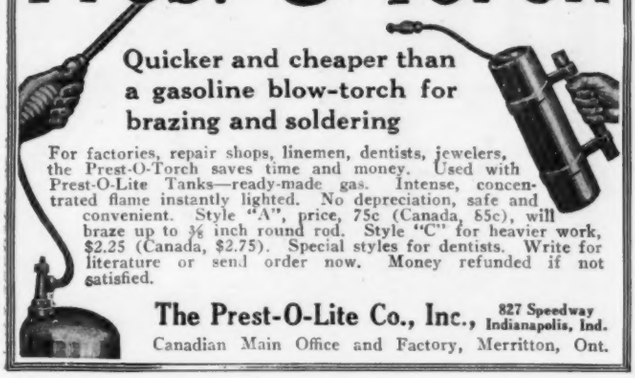

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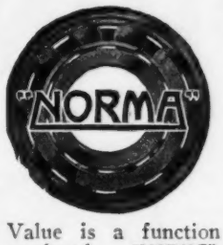

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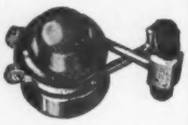

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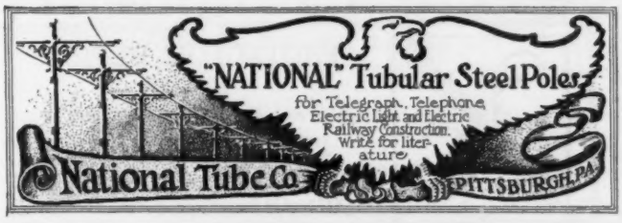
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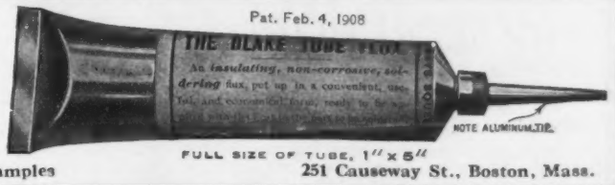

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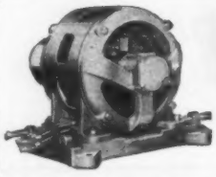

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O-B High Tension Insulators for any Voltage or Class of Service.

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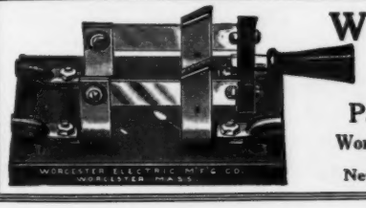
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Switchboards
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Worcester Electric & Mfg. Co.
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Automatic Reclosing Circuit Breaker
For D.C. sub-station operation without an operator. Localizes D.C. trouble; automatically restores service. Protects D.C. machines from starting with box out. A safeguard to men, machines and feeders.
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ALLEN
Non Acid Soldering Flux
300% Stronger Than Acid
Get the quality in your flux that you demand in your soder and your wire.
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for armature insulation, etc.
can be pressed into any form and *Will—Not—Crack*
IN ROLLS OR SHEETS
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Aristos "COPPERWELD"—Copper Clad Steel Wire—
Beats Solid Copper 40 Ways
Cheaper—Lighter—Stronger—Higher Elastic Limit—Costs less to Maintain
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for All Purposes, Any Frequency, Capacity or Commercial Voltage
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Main Office and Plant, Wellsville, N. Y.
Builders of Moore Steam Turbines & Reduction Gears.
Turbo-Generators, Turbo-Pumps, Turbo-Blowers.
Turbines for belt or rope drive.
Quick Shipments. Offices in all large cities.

Cary Springs Mean Quality
Watched and tested throughout all the processes of manufacture. None but the best allowed to go to the consumer. For all purposes and of every description and size. Steel Fishing Snake for Electrical and Conduit Work.
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for Central Stations
Albert & J. M. Anderson Mfg. Co.
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WATERWHEEL GOVERNORS
THE STANDARD FOR
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50 cents per Stick

$5.00 per dozen
Prevents Sparking and Cutting. Puts a high gloss on the commutator. Does not gum the brushes.
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Used in many of the world's largest water-works projects. Made of Oregon or Douglas Fir; in continuous Stave Pipe up to 12 feet inside diam. Also Machine Banded, 2-in. to 24-in. Cannot rust or become incrusted. Stands high pressure and any temperature.
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INTER-POLE MOTORS
For all electric drives. Constant or adjustable speed. Freedom from sparking. It's due to the INTER-POLES.
Bulletins mailed on request.
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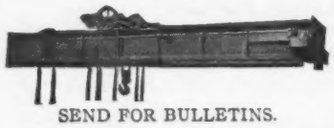
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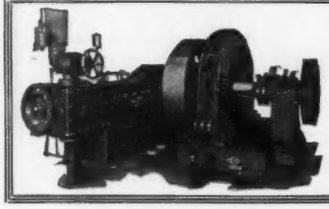
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Synchronous Motors
Induction Motors
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Minneapolis, Minn. 6

Green Chain Grate Stokers
For Water Tube and Tubular Boilers
GREEN ENGINEERING CO.
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Bulletin No. 1 Green Chain Grate Stokers
Bulletin No. 2 Geco Steam Jet Ash Conveyors

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WOODWARD Waterwheel GOVERNORS
Built in All Types and Sizes From the Smallest to the Largest
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Commutators and Commutator Segments
for Electric Starters and Lighters and all other types of D. C. Motors.
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Steam Superheaters Mechanical Stokers

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Write for Catalogue 42

It goes into details about the handling of materials—quickly and economically — with the Hayward Electric Motor Bucket.

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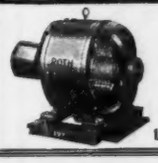
Buy it by the box-easy to stock and handle

DURADUCT

Use Rothmotors For Hard Service



Inefficient motors mean power waste, costly breakdowns and delays. Don't take chances! Let us tell you how we have solved motor problems for hundreds of manufacturers for over 20 years. The facts will interest and help you. Write today.

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ANY SIZE
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400 STROKES PER MINUTE
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Accurate Die-Castings

The Acme Die-Casting process insures accuracy, strength—a smooth, clean casting ready for assembling. Send for prices.

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All styles and designs built to suit your location. Send at once for our illustrated catalog.

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RELIANCE ADJUSTABLE SPEED MOTORS

Run at any speed with a constant horsepower output over any range up to 1 to 10.
No electric controller used.

Reliance Electric & Engineering Co.
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FEED WATER HEATERS

The National Pipe Bending Company
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Steam Turbine Oiling & Filtering Systems

Are described in our catalog L 10. Write for your copy. See our ad in last week's issue.

The Richardson-Phenix Co.
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Noiseless Pinions

for motor and other high speed drives, see our large advertisement in first issue of the month.

New Process Gear Corporation
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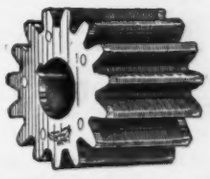

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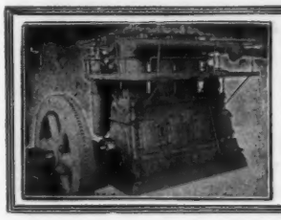
The Green Fuel Economizer Co.

90 West Street, New York, N. Y. Works, Beacon, N. Y.



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AUBURN, N. Y.

New York Office, 149 Broadway

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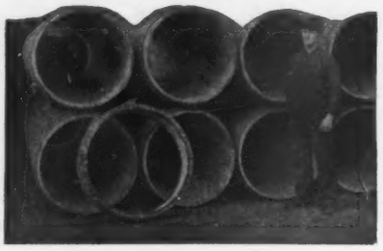
We sent this "National Quality" Wood Pipe to Alaska

It gave perfect satisfaction. "National Quality" Wood Tanks and Pipe give 100% service under all conditions.



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RILEY UNDERFEED STOKERS

The Stoker with the Reciprocating Retort Sides

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Sanford Riley Stoker Co., Ltd.
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THE EDGE MOOR WATER TUBE BOILER

Especially Suitable for Large Power Plants

Steel construction throughout. Straight tubes. All hand-holes elliptical, their covers internal and removable through their own openings. Unrestricted circulation permitting forcing of fires with safety and economy.

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are used EXCLUSIVELY by some of the most prominent manufacturers of various electrical apparatus, demonstrating thereby their important standing in the electrical field.

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Die-Castings in Brass and Bronze, Aluminum and White Metal Alloys

DUNTLEY UNIVERSAL Electric Drills

Operate interchangeably on direct or alternating current. Attach to ordinary lamp socket. Made in a wide variety of sizes and styles.

We also manufacture Duntley Electric Grinders, Hoists and Hammers.

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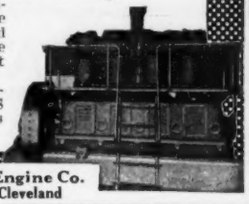
Branches Everywhere. K-1

Bruce-Macbeth Gas Engines

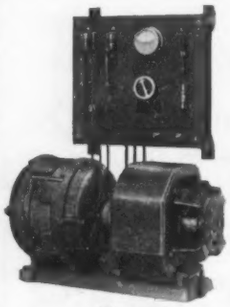
Now more than ever before, economy in industrial upkeep and elimination of waste are necessary.

True *economizing*—at the present time—means using extreme care when purchasing needed equipment, to see that the above factors are embodied to fullest advantage.

The most complete investigation of BRUCE-MACBETH GAS ENGINES, along these lines, is welcomed.



The Bruce-Macbeth Engine Co.
2122 Centre St., N. W., Cleveland



Type 3-G Motor Generator

A sure source of profit for

GARAGE and BATTERY STATIONS

Our 3-G Motor Generator charges from one to eight 6-volt batteries at one time. Simplest motor generator set made. Can be handled by inexperienced help—it can't go wrong.

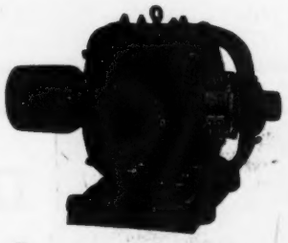
Other Motor Generator Sets for charging up to 24 batteries at one time.

Write for Catalog No. 4.

ST. LOUIS ELECTRICAL WORKS
4062 Forest Park Blvd. St. Louis

Built for Hard Service—from Bearings to Brush-Holders

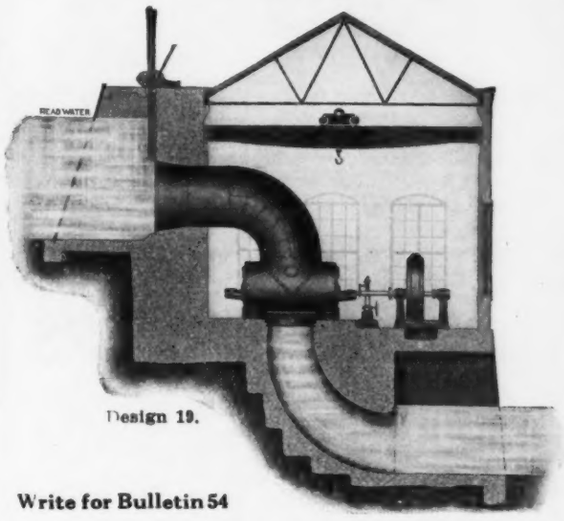
Even the brush-holders in Triumph motors and generators are of special design—a pattern the efficiency of which is the fruit of years of experience. Same way about all Triumph features. That's why—summed up—Triumph machines mean a maximum of service. Write for data.



The Triumph Electric Co., Cincinnati, Ohio
Branches in All Principal Cities

SAMSON TURBINE WATER WHEELS

High Speed, High Horse Power, High Efficiency
Vertical and Horizontal Designs



Design 19.

Write for Bulletin 54

THE JAMES LEFFEL & CO.
308 Lagonda Street, Springfield, Ohio, U. S. A.

SALES ENGINEERS
L. B. Dow, Inc., 79 Milk St., Boston, Mass.
Colby Engineering Co., Inc., 70 First St., Portland, Ore.
H. H. White, 378 Piedmont Ave., Atlanta, Ga.
William Hamilton Co., Ltd., Peterborough, Ont., Canada.

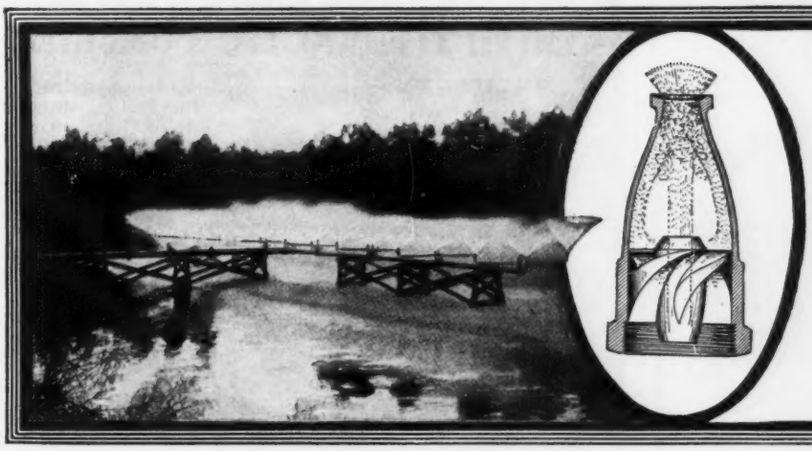
Saving every possible cent of cost at the power plant of the United Railway & Electric Co., Baltimore, Md., by means of

HUNT COAL HANDLING EQUIPMENT

C. W. HUNT CO., INC.

West New Brighton, N.Y., U.S.A.
61 Broadway New York City
Munsey Bldg., Washington, D.C.
Fisher Bldg., Chicago, Ill.

3



COOLING PONDS

reach their highest efficiency only when equipped with "Spraco" patent nozzles because their *double jets* (center flow and rotary) combine to produce a complete "bouquet" atomization—not a cone spray as with ordinary nozzles.

Get our new bulletin which tells how and why the "SPRACO" nozzle gives you *twice* the cooling power with *half* the water.

The Spray Engineering Co.
93 Federal St., Boston, Mass.

2

Read that article →

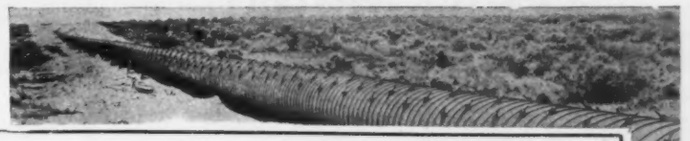
Then remember that we make perfect

Continuous Stave Wood Pipe and Machine Banded

in all sizes, for Power Plants and for Water Works. Catalog, prepared by well-known engineers, sent on request.

Washington Pipe & Foundry Co.

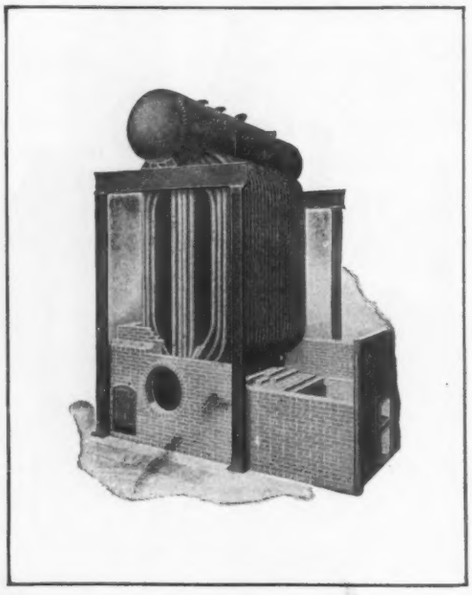
TACOMA, WASH., U. S. A.
New York Office, Woolworth Building



Wood Pipe Ages Less Than Iron or Steel

Based both on theoretical investigations and on field tests, the author of Bulletin 376 of the U. S. Department of Agriculture concludes that wood pipe will convey about 15 per cent more water than a ten-year-old cast-iron pipe or a new riveted pipe, and about 25 per cent more than a cast-iron pipe twenty years old or a riveted pipe ten years old.—*Engineering Record, March* 31, 1917.

Get the Boiler that has *4000 Less Parts*



Last week we pointed out to you that the ordinary 400 tube hand hole type of boiler has 800 *hand holes*—every one a chance for trouble and every one a joint that has to be broken down, made up and worried about every time the boiler is cleaned. And we told you that Erie City Vertical Water Tube Boilers have *no* hand holes. But you don't get the real importance of this feature of

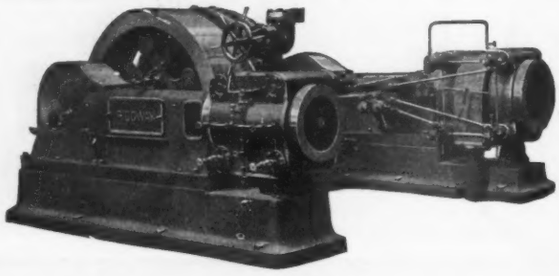
ERIE CITY VERTICAL WATER TUBE BOILERS

until you consider this: Each hand hole has five parts—the hand hole, gasket, crab, bolt and nut—4000 *extra parts* incidental to the 800 hand holes! And you know that *every* added part to a boiler means one more chance for trouble. So by *eliminating* in Erie City boilers these 4000 extra parts we offer you a boiler that on this score alone offers 4000 *less chances for trouble.* Think *that* over, too. Then *write us.*

Erie City Iron Works
Erie, Pa.

2

RIDGWAY UNITS



Well "Mated"

Marry two people of widely dissimilar characteristics and you've set the scene for a divorce.

Hook up a dynamo and engine without proper regard for their mutual operating characteristics and you'll have a poor unit.

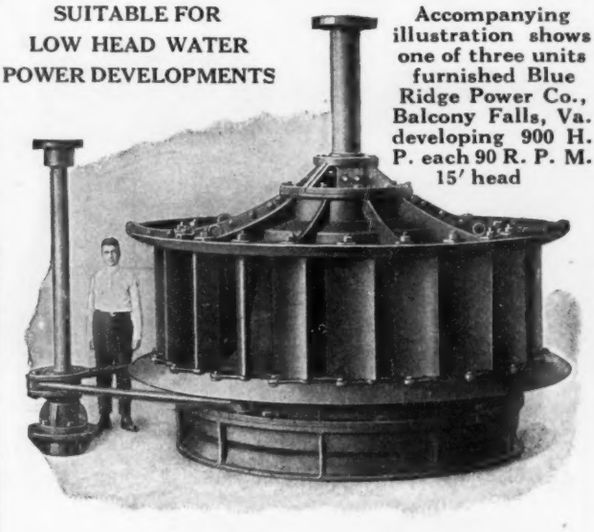
The safe and sure way is to buy a RIDGWAY UNIT—engine and generator mated "from the cradle." Write for Bulletins.

Ridgway Dynamo & Engine Co.
Ridgway, Pa.

SMITH HYDRAULIC TURBINES

SUITABLE FOR LOW HEAD WATER POWER DEVELOPMENTS

Accompanying illustration shows one of three units furnished Blue Ridge Power Co., Balcony Falls, Va. developing 900 H. P. each 90 R. P. M. 15′ head



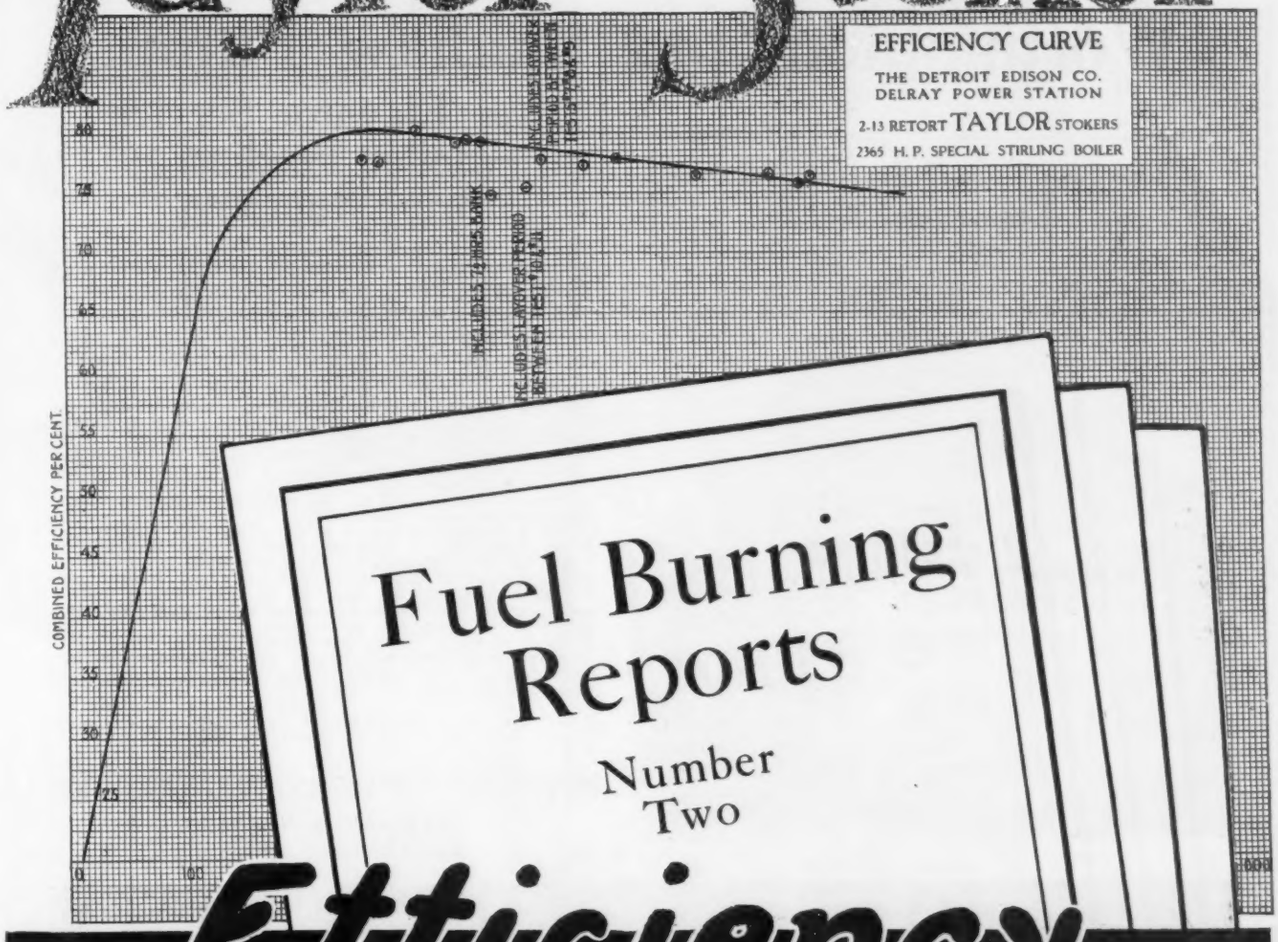
The Successful and Continuous Operation of a Modern Hydroelectric Unit depends largely upon design and construction of the water wheel. **Note the Heavy Construction Illustrated,** which accounts for the extraordinary service assured our customers.

If interested in Water Power, write Dept. "W" for Bulletin.

S. MORGAN SMITH CO., YORK, PA.

Branch Offices: 176 Federal St. BOSTON | 76 W. Monroe St. CHICAGO | 405 Power Bldg. MONTREAL

Taylor Stoker



Fuel Burning Reports

Number Two

Efficiency

In so far as we know, we have been, and probably are today, the only manufacturers of stokers who present information relative to their apparatus in the form of characteristic curves showing the performance of the stoker at any rating of operation. With these curves you can readily determine what you may expect of your prospective stoker installation when applied to your load conditions.

In booklet No. 2 of our series of published "FUEL BURNING REPORTS" we have compiled a number of these characteristic TAYLOR Stoker performance curves showing the results of some most interesting tests. Several of these curves are accompanied by the complete tabulation of the test conditions and results. Each curve represents the characteristic performance of a TAYLOR Stoker, with varying rates of fuel burning in terms of water evaporated. From the curves the combined boiler and furnace efficiency can be obtained at any rate of fuel burning.

Remember that this booklet is not an ordinary aggregation of *claims* as to the efficiency of TAYLOR Stokers; it contains nothing but self-evident *proof* of TAYLOR Stoker efficiency, as determined by authentic and exacting tests. Every engineer interested in combustion efficiency should have a copy of this booklet, "FUEL BURNING REPORTS" No. 2. *Sent free on request.*

American Engineering Company, Philadelphia

Published by
The American Engineering Co.

Tests

WORTHINGTON PUMP AND MACHINERY CORPORATION

Worthington and Laidlaw Pumps

for Elevator Service —Boiler Feeding —Brine Pumping

The Broadway Department Store
Los Angeles, Cal.

The Broadway Store is a modern nine-story structure with basement and sub-basement, covering eleven acres of floor space.

Its elevator service consists of thirteen passenger, and four freight cars. The passenger cars have a speed of 425 feet per minute; the freight cars, 110.

The Pumping Engine for elevator service is a **Laidlaw** three cylinder, 20 x 25 x 25 x 13½ x 24, furnishing 2400 gallons per minute for the seventeen cars.

Night and Sunday service is furnished economically by two **Worthington Turbine Pumps,** each a 6" three stage, direct connected to a 200 H.P. Westinghouse motor. The pumps each have a capacity of 1300 G.P.M. against 175 lbs. pressure. These pumps are said to be the largest turbine elevator pumps in use in this country. Their large capacity was the direct reason for the choice of an exactly similar unit for the Bullock Department Store, Los Angeles.

Other Worthington Pumps in the Broadway Department Store are: two 6 x 46 Duplex Boiler Feed Pumps; one 6 x 4 x 6 Duplex Pump for brine pumping.

The excellent service obtained from these Worthington Products furnishes an example of units whose design, construction and performance record is strikingly adequate to the conditions of service.

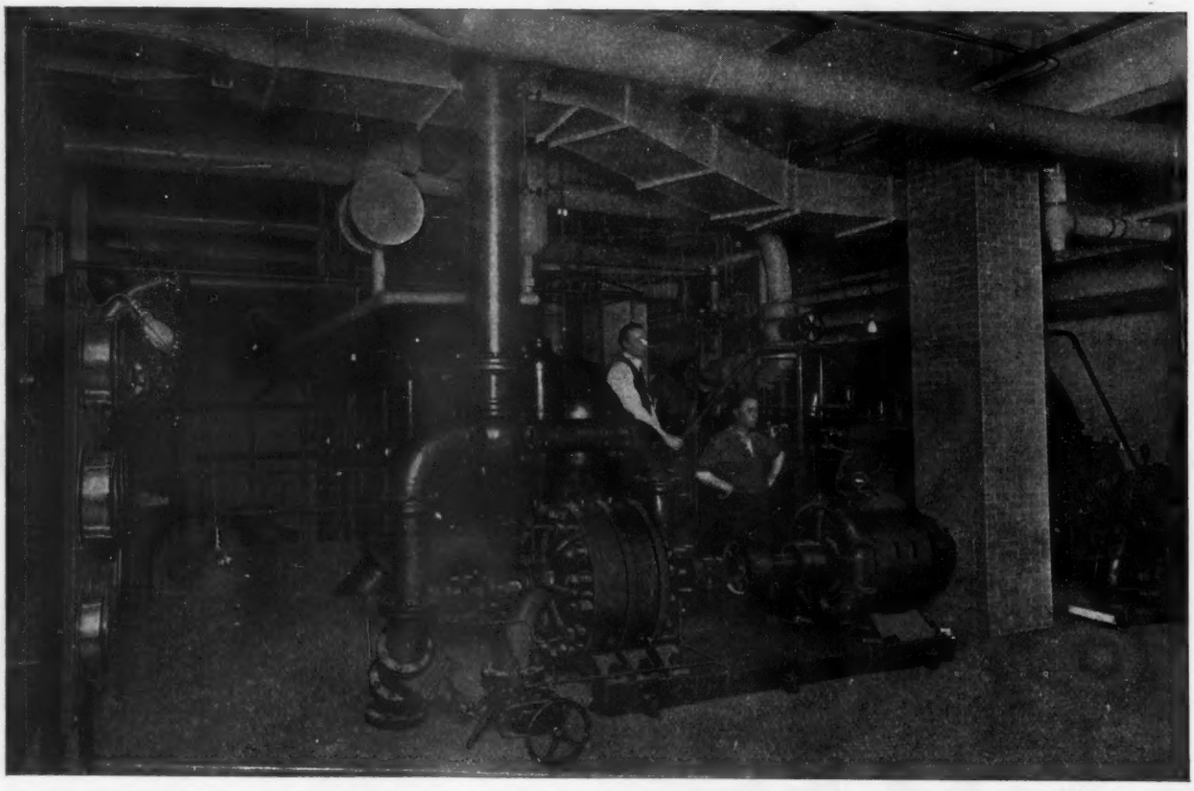
Back of this and many other notable installations, lies a ripe and valuable experience in the manufacture of hydraulic machinery, which is freely offered to engineers who have pumping problems.

On request, we will send bulletins covering any or all types of pumps, condensers, air compressors, water meters.

WORTHINGTON PUMP AND MACHINERY CORPORATION

115 Broadway, New York

Branch Offices in all Principal Cities 148.8



Report to Home Office

Dear Boss:

I don't like to spoil any of your present delivery schedules, but here is an order for heater cord that must get into the works in jig time.

The Big Birthday Blowout on the Fourth will of course cut a hole in the schedule, but that's in a good cause and excusable.

In taking this order Mac said that we ought to make up the cord with a lot of flossy colors, as it would help sell the devices.

I told him that the object of our heater cord was not to sell devices but to **keep them sold**—that our cord was much like July 4th, 1917, in that the big noises were to be shot off for **a cause** this year—not for an effect—that if in battle or business we practise hypocrisy we'll not get the universe safe for democracy.

Nyl Chrome

DRIVER-HARRIS COMPANY

CHICAGO 28 So. JEFFERSON ST HARRISON, N. J. MANCHESTER ENGLAND

Coming!

The New Science of Soldering

—introducing an iron that becomes hot *instantly,* no waiting—eliminates applying solder to iron—requires no tinning—light weight; easier to handle—saves current; no heat loss—and produces better, stronger and MORE work at LESS cost

The booklet above *tells the story*; the coupon below *brings the booklet.* Mail it NOW.

CLEMENS ELECTRICAL CORPORATION

725 Main Street, Buffalo, N. Y.

Central Electric Co., 320 South Fifth Ave., Chicago, Ill. The Commercial Electrical Supply Co., 15th & Pine Sts., St. Louis, Mo. The W. G. Nagel Electric Co., 28 St. Clair St., Toledo, Ohio. The Interstate Electric Co., Baronne & Perdido Sts., New Orleans, La. The Post-Glover Electric Co., 314 West Fourth St., Cincinnati, Ohio. Mohawk Electrical Supply Co., 325 South Warren St. Syracuse, N. Y. Stuart-Howland Co., Congress & Purchase Sts., Boston, Mass. R. B. Clapp, San Fernando Bldg., Los Angeles, Calif. Wm. P. Johnson Electric Co., 8 North Sixth St., Minneapolis, Minn. Robbins Electric Co., 830 Liberty Ave., Pittsburgh, Pa. H. C. Rober's Electric Supply Co., 905 Arch St., Philadelphia, Pa. Baltimore Electrical Supply Co., Baltimore, Md. and Atlanta, Ga.

THIS COUPON BRINGS IT

Clemens Electrical Corporation

725 Main Street, Buffalo, N. Y.

Gentlemen: Kindly send the writer a copy of your new booklet—"The Elimination of Lost Motion in Soldering."

Name .....

Company .....

Position .....

Address .....

LINCOLN MOTORS

That's All There Is To It

"The Lincoln Motor is the simplest piece of machinery in my shop," says one superintendent of a large plant.

"—Here's the stator, with the insulated windings which carry the electric current from the supply line.

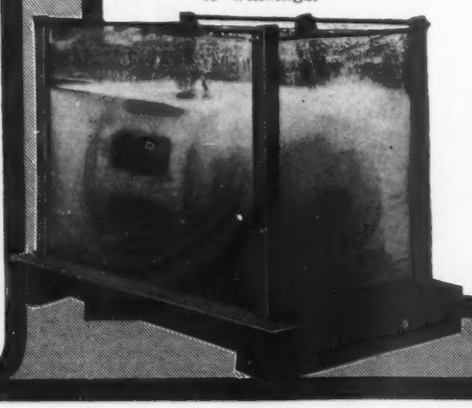
"—Inside of it is the rotor mounted on a steel shaft and rotated rapidly by the action of the electric current.

"—and on either end of the shaft is an end bracket with a well oiled bearing for the shaft to turn in.

"That's all there is to it."

Write for Bulletin on Motors 101 E

This standard Lincoln Motor has operated under water for over 3 years, without damage to windings.



"Link Up With Lincoln"

The Lincoln Electric Co.

Cleveland, Ohio

New York City (Singer Bldg.)
Buffalo
Syracuse
Chicago
Columbus
Detroit
Grand Rapids
Philadelphia
Pittsburgh
Charlotte, N. C.
Toronto, Canada

Agencies in other principal cities

Three sources of trouble removed

In the Electric Light and Power Plant Field

1—HYDRO-ELECTRIC PLANTS

A GREAT difficulty encountered in hydro-electric plants is the fact that many places which come in contact with water are troublesome to lubricate. Most lubricants are washed off. Furthermore, the water used is frequently contaminated and causes corrosion of the metal. In a great many cases this has been accepted as a necessary evil, but this conception is wrong.

As a typical instance we would quote the case of a large hydro-electric development in which the water has a large organic acid content, due to sewerage. Here, by lubricating the exposed bearings and by coating the submerged parts with TEXACO CRATER COMPOUND all trouble was eliminated several years ago and has been removed permanently.

TEXACO CRATER COMPOUND is a pure, heavy lubricant which is not washed off by water and which resists chemical action. It is used to great advantage on gates, valve rigging, chains, etc. It is a highly successful gear lubricant and can be used indoors and outdoors.

We have on hand a booklet called "About Texaco Crater Compound," which explains its use in hydro-electric plants. It is interesting and valuable reading.

2—ON STEAM TURBINES

MANY operators of steam turbines have had the sad and costly experience of dumping a lot of emulsified turbine oil or renewing corroded shafts and bearings.

This is generally due to the fact that the turbine oil you used held water because of impurities in the oil.

But all turbine oils are not like this.

There is TEXACO CETUS OIL, a specially prepared, filtered lubricant for turbines. It is a pure mineral oil. Contains no foreign matter.

CETUS separates readily from water. It is easily filtered. It can be used continuously without losing its brightness. It does not emulsify. It cannot cause corrosion. It does not wear out.

TEXACO CETUS OIL is made for steam turbines of all sizes and is made right.

3—ON DIESEL ENGINES

MANY of the electric light and power plants, particularly in the South and Southwest, are using Diesel Engines or other types of heavy oil engines.

We have gone into this field and achieved remarkable success in eliminating what appeared to be on the face of it a chronic trouble, namely, hard carbon deposits in the cylinders. We have done this in case after case by installing TEXACO URSA OIL, the Diesel Engine lubricant.

TEXACO URSA OIL burns clean—does not leave any troublesome deposits.

Furthermore, TEXACO URSA OIL simplifies the matter of running a Diesel because this oil lubricates the entire unit—power cylinders, air compressors and all the bearings. This is a factor of safety which merits your consideration.

No danger of getting the wrong oil in any one of these places. URSA takes care of them all.

We will be glad to quote you prices and give you further particulars at all times. And if you are interested in the subject of efficient lubrication, you should be on the mailing list for our monthly magazine, "Lubrication," sent free to readers of Electrical World who ask for it.

There is a TEXACO Lubricant for Every Purpose

THE TEXAS COMPANY
Dept. L, 17 Battery Pl., New York City
HOUSTON CHICAGO NEW YORK
Offices in Principal Cities

How to Read a Circulation Statement

Electrical World Circulation by States Compared with Urban Populations

State	Individual Mail Subscribers	Urban Population Per Copy
Maine	153	2493
New Hampshire	84	3035
Vermont	56	3017
Massachusetts	960	3256
Rhode Island	109	4813
Connecticut	349	2864
New York	2508	2865
New Jersey	607	3142
Pennsylvania	1481	3126
Delaware	33	2942
Maryland	187	3520
District of Columbia	151	2192
Virginia	179	2662
North Carolina	106	3004
South Carolina	81	2775
Georgia	177	3043
Florida	51	4295
Kentucky	95	5846
West Virginia	129	1768
Tennessee	133	3316
Alabama	81	4573
Mississippi	35	5923
Louisiana	72	6896
Texas	367	2556
Oklahoma	97	3300
Arkansas	65	3118
Ohio	932	2859
Indiana	468	2444
Illinois	998	3484
Michigan	490	2708
Wisconsin	459	2185
Minnesota	412	2064
Iowa	414	1642
Missouri	425	3291
North Dakota	77	821
South Dakota	74	1036
Nebraska	191	1622
Kansas	220	2244
Montana	136	1000
Wyoming	51	848
Colorado	196	2066
New Mexico	39	1194
Arizona	84	753
Utah	103	1679
Nevada	25	535
Idaho	76	920
Washington	254	2384
Oregon	118	2602
California	673	2184

MOST of us have a very confused idea as to the true inwardness of those mystic tabulations which publishers call "circulation statements."

We comprehend totals—little else. When we see that 25 copies of Electrical World are sold in Nevada and 2500 in New York, we conclude that the paper is strong in the East and weak in the West. But when we put pencil to paper and learn that there is a copy to each 525 of urban population in Nevada and one for each 2865 of urban population in New York, this hasty conclusion calls for revision.

The distribution of Electrical World follows almost exactly the electrical development in the different parts of the country. The center of the country's population and the center of Electrical World circulation fall within thirty miles.

Measure it by urban population, for example. In the cities are the central stations, the factories with their isolated plants, the great street lighting systems, the centers of huge Government purchases, the bases of electric automobile fleets. The average urban population per copy of Electrical World is 2793, and in thirty states the circulation varies hardly ten per cent above or below this average.

A test frequently applied by general advertisers is to ascertain the number of automobiles per capita in states where a magazine circulates. This test gives a fair guide to the community's buying power, especially of articles like electrical appliances, fixtures, house-wiring equipment, etc. Applying the "automobile test" to Electrical World's circulation, we find that it is strongest where cars are most numerous.

* * * * * *

These notes suggest some of the ways in which circulations are, should be, analyzed. General advertisers whose appropriations run into large sums now habitually apply the most rigid tests to the publishers' statements.

This is just. A publisher sells one commodity—circulation. It is proper that this commodity should be examined for quality and quantity. It is proper that the sale and purchase of advertising space should be safeguarded by the same cold business considerations as rule a bank transaction or the purchase of a piece of machinery.

Electrical World welcomes such strictness.

What Advertisers Offer to Readers

Classified Index of Products of Representative Manufacturers and Dealers Advertising in This Issue

Acetylene in Cylinders.
Prest-O-Lite Co., Inc.

Air Compressors.
Allis Chalmers Mfg. Co.
General Electric Co.
Worthington P. & M. Corp.

Air Washers and Coolers.
Spray Engrg. Co.

Aluminum.
Aluminum Co. of America

Ammeters, Voltmeters. (See Instruments, Electrical.)

Anchors, Guy.
Hubbard & Co.
Matthews & Bro., Inc., W. N.

Automobiles, Elec.
General Vehicle Co.
Ward Motor Vehicle Co.

Batteries, Dry Cell.
Western Elec. Co.

Batteries, Primary.
Manhattan Elec'l Supply Co.

Batteries, Storage.
Edison Storage Battery Co.
Electric Storage Battery Co.

Battery Charging Apparatus.
Lincoln Elec. Co.

Battery Charging Sets, Mot.-Gen.
St. Louis Elec'l Works.

Bearings, Ball.
Gurney Ball Bearing Co.
Norma Co. of America
S K F Ball Bearing Co.

Bells.
Manhattan Elec'l Supply Co.

Blast Furnaces.
Riter-Conley Co.

Boilers, Steam.
Babcock & Wilcox Co.
Edge Moor Iron Co.
Erie City Iron Works.

Bolts, Expansion.
Hubbard & Co.

Bond Testers.
Roller-Smith Co.

Books, Technical.
McGraw-Hill Book Co., Inc.

Boosters.
Crocker-Wheeler Co.
General Electric Co.
Ridgway Dynamo & Eng. Co.
Triumph Electric Co.
Westinghouse Elec. & Mfg. Co.

Boxes, Fuse.
Electric Fuseguard Co.
G & W Electric Specialty Co.
General Electric Co.
Matthews & Bro., Inc., W. N.
Metropolitan Eng'g Co.

Boxes, Junction and Outlet.
Chicago Fuse Mfg. Co.
D & W Fuse Co.
Electric Fuseguard Co.
G & W Electric Specialty Co.
General Electric Co.
National Metal Molding Co.
Sprague Electric Works.

Boxes, Meter and Service.
Metropolitan Eng'g Co.

Brackets and Pins, Metal.
Hubbard & Co.
Pittsburgh Transformer Co.

Brushes, Dynamo.
American Carbon & Battery Co.
General Electric Co.
Jeandron, W. J.
Morgan Crucible Co., Ltd.

Buildings, Steel.
Blaw Steel Construction Co.

Buckets, Excavating, Motor-Driven.
Hayward Co.
Link-Belt Co.

Buckets, Grab.
Link-Belt Co.

Bushings.
Condit Electrical Mfg. Co.
Diamond State Fibre Co.
National Metal Molding Co.

Cable End Bells.
Cope, T. J.
Elec'l Engineers Equipment Co.
G & W Electric Specialty Co.

Cable Racks.
Cope, T. J.
Elec'l Engineers Equipment Co.
Hubbard & Co.
Metropolitan Eng'g Co.

Cable Splicing Joints.
Elec'l Engineers Equipment Co.
Frankel Connector Co., Inc.
Matthews & Bro., Inc., W. N.

Cable Winches.
Cope, T. J.

Cabling Machinery.
American Ins. Machinery Co.
New England Butt Co.
Torrington Mfg. Co.

Carbon Brushes.
American Carbon & Battery Co.
Jeandron, W. J.
Morgan Crucible Co.

Castings.
Triumph Elec. Co.

Castings, Die.
Acme Die Casting Corp.
Doehler Die-Casting Co.

Circuit Breakers.
Automatic Reclosing Circuit Breaker Co.
Condit Electrical Mfg. Co.
Cutter Co., The.
General Electric Co.
Industrial Controller Co.
Roller-Smith Co.
Sangamo Elec. Co.
Sundh Elec. Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.

Clamps, Cable Supporting
Elec'l Engineers Equipment Co.

Clamps, Ground Connections.
Frankel Connector Co., Inc.
General Electric Co.

Clamps, Guy.
Hubbard & Co.
Matthews & Bro., Inc., W. N.

Clamps, Insulator.
Elec'l Engineers Equipment Co.

Cleats.
Blake Signal & Mfg. Co.
Colonial Sign & Ins. Co.
General Electric Co.
Imperial Porcelain Co.
National Metal Molding Co.
Thomas & Sons Co., R.

Climbers.
Klein Sons, Mathias.

Clips, Cable.
Hubbard & Co.

Clusters.
Hubbell, Inc., Harvey.

Coal and Ash Handling Machinery.
Hayward Co.

Coal Bunkers.
Link-Belt Co.

Coils, Armature, Field.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.

Coils, Choke.
General Electric Co.

Commutators.
Cameron Electric Mfg. Co.

Compounds, Commutator.
McLellen Co., K.

Condensers.
Manistee Iron Works.
Wheeler Condenser & Eng. Co.

Conduit Bends.
Fibre Conduit Co.

Conduit Rods.
Cope, T. J.

Conduit Fittings.
Sprague Electric Works.

Conduits, Interior.
American Circular Loom Co.
National Metal Molding Co.
Sprague Electric Works.
Tubular Woven Fabric Co.

Conduits, Underground.
Fibre Conduit Co.
Gest, G. M.

Connectors and Terminals.
Elec'l Engineers Equipment Co.
Frankel Connector Co., Inc.

Controllers, Motor.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Industrial Controller Co.
Monitor Controller Co.
Sundh Electric Co.
Ward Leonard Electric Co.

Conveying Machinery. (Coal, Ashes, Etc.)
American Bridge Co.
Green Engineering Co.
Hunt Co., Inc., C. W.

Cooling Ponds, Spray.
Spray Engrg. Co.

Cord Adjusters.
American Vul. Fibre Co.
Diamond State Fibre Co.

Cord, Arc Lamp.
Samson Cordage Works.

Cord, Flexible.
Belden Mfg. Co.
General Electric Co.
Rome Wire Co.

Cord, Trolley.
Samson Cordage Works.

Couplings, Flexible.
Bruce-Macbeth Engine Co.
Smith-Serrell Co., Inc.

Couplings, Magnetic.
Cutler-Hammer Mfg. Co.

Cranes, Motor.
Crocker-Wheeler Co.
Sprague Electric Works.
Triumph Electric Co.
Westinghouse Elec. & Mfg. Co.

Cranes, Traveling.
American Bridge Co.
Maris Bros.

Cross Arms.
American Bridge Co.
Hubbard & Co.
Thomas & Sons Co., R.
Western Elec. Co.

Cutouts.
D & W Fuse Co.
G & W Electric Specialty Co.
Matthews & Bro., Inc., W. N.
Metropolitan Eng'g Co.
Palmer Elec. & Mfg. Co.

Cutting Apparatus, Oxy-Acetylene.
Prest-O-Lite Co., Inc.

Drills, Brick.
Hubbard & Co.

Dynamos and Motors.
Allis-Chalmers Mfg. Co.
Burke Elec. Co.
Century Electric Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Electric Machinery Co.
Electro-Dynamic Mfg. Co.
Emerson Electric Mfg. Co.
General Electric Co.
Gregory Electric Co.
Kimble Electric Co.
Lincoln Electric Co.
Reliance Elec. & Eng'g. Co.
Ridgway Dynamo & Engine Co.
Robbins & Myers Co.
Roth Bros. & Co.
Sprague Electric Works.
Wagner Electric Mfg. Co.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

Economizers, Fuel.
Green Fuel Economizer Co.

Electromagnets.
Acme Wire Co.
Cutler-Hammer Mfg. Co.
Elec. Controller & Mfg. Co.
Ward Leonard Elec. Co.

Engineers, Consulting and Contracting. (See also Directory of Engineers.)

Engines, Gas and Gasoline.
Allis-Chalmers Mfg. Co.
Bruce-Macbeth Engine Co.
Carlisle & Finch Co.
General Electric Co.
Worthington P. & M. Corp.

Engines, Oil.
Chicago Pneumatic Tool Co.
Worthington P. & M. Corp.

Engines, Steam.
Allis-Chalmers Mfg. Co.
McIntosh & Seymour Corp.
Ridgway Dynamo & Eng. Co.

Excavating Machinery, Motor-Driven.
Hayward Co.

Experimental Apparatus.
Biddle, James G.
Leeds & Northrup Co.
Roller-Smith Co.

Fan Motors.
Adams-Bagnall Electric Co.
Century Elec. Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Emerson Electric Mfg. Co.
Robbins & Myers Co.
Sprague Electric Works.
Western Elec. Co.

Fans (Exhaust and Ventilating).
Adams-Bagnall Electric Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Emerson Elec. Co.
Green Fuel Economizer Co.
Kimble Elec. Co.
Robbins & Myers Co.
Sprague Electric Works.
Westinghouse Elec. & Mfg. Co.

Fault Finders, Cable.
Matthews & Bro., Inc., W. N.

Fibre.
American Vul. Fibre Co.
Continental Fibre Co.
Diamond State Fibre Co.
Fibre Conduit Co.
Spaulding & Sons Co., J.

Filters, Oil.
Richardson-Phenix Co.

Financial.
Coal & Iron National Bank.
Electric Bond & Share Co.

Fixtures, Electric and Gas.
Adams-Bagnall Electric Co.

Flashers.
Campbell Electric Co.

Fuse Boxes. (See Boxes, Fuse.)

Fuses.
Chicago Fuse Mfg. Co.
Clemens Elec'l Corp.
Condit Electrical Mfg. Co.
D & W Fuse Co.
Daum, A. F.
Economy Fuse & Mfg. Co.
Electric Fuseguard Co.
General Electric Co.
Metropolitan Eng'g Co.
Multi-Refillable Fuse Co
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Western Electric Co.

Fuses, Refillable.
Clemens Elec'l Corp.
Daum, A. F.
Economy Fuse & Mfg. Co.
Electric Fuseguard Co.
Multi-Refillable Fuse Co.

Gas Meters, Electric.
Cutler-Hammer Mfg. Co.

Gauges, Recording.
Bristol Co.
Foxboro Co., The.
Nelson Valve Co.

Gauges, Water Column.
Jenkins Bros.

Gears.
New Process Gear Corp.

Gear Shift, Electric.
Cutler-Hammer Mfg. Co.

What Advertisers Offer to Readers

Classified Index of Products of Representative Manufacturers and Dealers Advertising in This Issue

Generating Sets, Engine & Turbine.
Sturtevant Co., B. F.

Globes, Shades, Etc.
Adams-Bagnall Electric Co.

Grounds, Etc.
Paragon Elec. Co.

Guards, Incandescent Lamp.
Hubbell, Inc., Harvey.
Matthews & Bro., Inc., W. N.

Hair Driers.
Shelton Elec. Co.

Hangers, Cable.
Condit Electrical Mfg. Co.
Hubbard & Co.

Head Gates.
American Bridge Co.

Heaters, Feed Water.
National Pipe Bending Co.

Heating Devices, Electric.
Cutler-Hammer Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Heating, Steam.
American District Steam Co.

Hoists, Electrical and Steam.
Allis-Chalmers Mfg. Co.
Maris Bros.
Sprague Electric Works.

Igniters, Gas Engine.
Carlisle & Finch Co.

Indicators, Sight Flow.
Richardson-Phenix Co.

Indicators, Speed.
Biddle, James G.
Roller-Smith Co.

Industrial Railways.
Hunt Co., Inc., C. W.

Injectors.
Jenkins Bros.

Instrument Transformers.
Weston Electrical Instr. Co.

Instruments, Electrical.
Graphic.
Biddle, James G.
Bristol Co.
General Electric Co.
Sangamo Elec. Co.
Westinghouse Elec. & Mfg. Co.

Indicating.
General Elec. Co.
Pignolet, L. M.
Roller-Smith Co.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Inst. Co.

Integrating.
Biddle, James G.
Duncan Electric Mfg. Co.
General Electric Co.
Roller-Smith Co.
Sangamo Electric Co.
Westinghouse Elec. & Mfg. Co.

Scientific and Testing.
Biddle, James G.
General Electric Co.
Leeds & Northrup Co.
Matthews & Bro., Inc., W. N.
Metropolitan Eng'g Co.
Roller-Smith Co.

Insulating Bases and Panels.
Stone Base & Paenl Co.

Insulating Machinery.
American Ins. Machinery Co.
New England Butt Co.

Insulating Material.
China and Porcelain.
Colonial Sign & Ins. Co.
Imperial Porcelain Works.
Lapp Insulator Co., Inc.
Locke Insulator Mfg. Co.
Ohio Brass Co.
Parker & Son, J. H.
Pittsburgh H. V. Ins. Co.
Thomas & Sons Co., R.

Compounds, Paints and Varnishes.
Diamond State Fibre Co.
General Electric Co.
Hemming Mfg. Co.
Irvington Varnish & Ins. Co.
Redmanol Chemical Products Co.
Sherwin-Williams Co.

Composition Cloth and Paper.
Diamond State Fibre Co.
Irvington Varnish & Ins. Co.
Mitchell-Rand Mfg. Co.

Fibre.
Amer. Vulcanized Fibre Co.
Continental Fibre Co.
Diamond State Fibre Co.
Spaulding & Sons Co., J.

Lava.
Steward Mfg. Co., D. M.

Mica.
Keene Mica Products Co.
Munsell & Co., Eugene.

Silk.
Irvington Varnish & Ins. Co.
Ryle & Co., Wm.

Tape.
Diamond State Fibre Co.
Mitchell-Rand Mfg. Co.
Standard Woven Fabric Co.

Insulating Paper.
Diamond State Fibre Co.
Irvington Varnish & Ins. Co.

Insulators.
China, Porcelain and Composition.
Colonial Sign & Ins. Co.
Imperial Porcelain Works.
Lapp Insulator Co., Inc.
Locke Insulator Mfg. Co.,
Ohio Brass Co.
Pittsburgh High Volt. Ins. Co.
Thomas & Sons Co., R.

Glass.
Brookfield Glass Co.
Hemingray Glass Co.
Lapp Insulator Co., Inc.
Locke Insulator Mfg. Co.

Insulator Pins.
Elec'l Engineers Equipment Co.
Hubbard & Co.
Thomas & Sons Co., R.

Jacks, Cable Reel.
Swett Iron Works, A. L.

Lamps, Arc.
Adams-Bagnall Electric Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Flaming Arc.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Lamps, Incandescent.
Boston Economy Lamp Div.
Chicago Elec. Lamp Co.
Consolidated Elec. Lamp Co.
General Electric Co.
Hygrade Lamp Co.
Independent Lamp & Wire Co.
Lux Mfg. Co.
National Lamp Works.
Western Elec. Co.

Lamps, Miniature.
General Electric Co.

Lamp Replacers.
Matthews & Bro., Inc., W. N.

Lava.
(See Insulating Material, Lava.)

Lightning Arresters.
Delta Star Elec. Co.
General Electric Co.
Hubbard & Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

Line Material.
Anderson Mfg. Co.. A. & J. M.
Archbold-Brady Co.
Elec'l Engineers Equipment Co.
G & W Elec. Specialty Co.
General Electric Co.
Hubbard & Co.
Matthews & Bro., Inc., W. N.
Ohio Brass Co.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

Linemen's Tools.
(See Tools, Linemen.)

Linemen's Shields.
Matthews & Bro., Inc., W. N.

Loose Leaf Binders.
Irving-Pitt Mfg. Co.

Lubrication Engineers.
Richardson-Phenix Co.

Lubricating Oils.
Texas Co.

Lubricators.
Richardson-Phenix Co.

Machines, Armature Notching.
Ferracute Machine Co.

Machines, Calculating.
Marchant Calculating Mach. Co.

Magnet Wire.
Acme Wire Co.
American Brass Co.
American Electrical Works.
American Steel & Wire Co.
Belden Mfg. Co.
Benedict & Burnham Mfg. Co.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.
Massachusetts Elec. Mfg. Co.
Roebling's Sons Co., J. A.
Rome Wire Co.
Western Elec. Co.

Magnets.
Acme Wire Co.

Magnets, Lifting.
Cutler-Hammer Mfg. Co.
Elec. Controller & Mfg. Co.

Mechanical Stokers.
American Engineering Co.
Riley Stoker Co., Ltd., Sanford.

Medical Apparatus.
Manhattan Electrical Supply Co.
Pignolet, L. M.

Meter Testers
States Company.

Meters, Flow.
Spray Engineering Co.

Meters, Liquid Recording.
Nelson Valve Co.

Mica.
Keene Mica Products Co.
Munsell & Co., Eugene.

Mining Machinery.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.

Molded Insulation.
Redmanol Chemical Products Co.

Molded Parts.
Belden Mfg. Co.
Cutler-Hammer Mfg. Co.
Hemming Mfg. Co.

Molding Metal.
National Metal Molding Co.

Motors.
(See Dynamos and Motors.)

Nippers and Pliers.
Klein & Sons, Mathias.

Novelties, Electric.
Carlisle & Finch Co.

Nozzles, Spray.
Spray Engineering Co.

Oiling Systems, Cutting.
Richardson-Phenix Co.

Oiling Systems, Hydro-electric.
Richardson-Phenix Co.

Oiling Systems, Sight Feed.
Richardson-Phenix Co.

Oiling Systems, Turbine.
Richardson-Phenix Co.

Oil, Lubricating.
Texas Co.

Oil, Transformer.
Texas Co.

Oils, Cylinder.
(See Lubricants.)

Oilers, Telescopic.
Richardson-Phenix Co.

Operators, Public Utilities.
Light & Development Co. of St. Louis.

Packing.
Jenkins Bros.

Panel Boards.
Adams-Bagnall Electric Co.
General Electric Co.
Trumbull Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Penstock.
Portland Wood Pipe Co.

Photometric Apparatus.
Elec'l Testing Laboratories.
Leeds & Northrup Co.

Pinions, Rawhide.
New Process Gear Corp.

Pipe, Wood.
National Tank & Pipe Co.
Portland Wood Pipe Co.
Washington Pipe & Foundry Co.

Pipe Fittings.
Richardson-Phenix Co.

Pipe (Riveted Steel).
Washington Pipe & Foundry Co.

Platinum.
Baker & Co., Inc.

Plugs.
Condit Electrical Mfg. Co.
Cutler-Hammer Mfg. Co.
Hubbell, Inc., Harvey.
National Metal Molding Co.

Pole Erectors.
American Bridge Co.
Matthews & Bro., Inc., W. N.

Pole Line Hardware.
Hubbard & Co.
Matthews & Bro., Inc., W. N.
Western Elec. Co.

Poles, Brackets, Pins, Etc.
Western Elec. Co.

Poles, Cedar.
Western Red Cedar Assn.

Poles, Reinforcing.
Hubbard & Co.

Poles, Steel.
American Bridge Co.
Archbold-Brady Co.
Bates Exp. Steel Truss Co.
Blaw Steel Cons. Co.
Coombs, R. D.
National Tube Co.
Western Elec. Co.

Poles and Ties, Wood.
Carney & Co., B. J.

Porcelain. (See Insulating Material, China and Porcelain.)

Potentiometers.
Biddle, James B.
General Electric Co.
Leeds & Northrup Co.

Potheads.
Colonial Sign & Insulating Co.
Elec'l Engineers Equipment Co.
G & W Elec. Specialty Co.
Okonite Co., The.

Protective Devices.
General Electric Co.
Metropolitan Engineering Co.
Schweitzer & Conrad, Inc.

Pumps, Air.
Worthington P. & M. Corp.

Pumps, Centrifugal.
Allis-Chalmers Mfg. Co.

Pumps, Oil.
Richardson-Phenix Co.
Worthington P. & M. Corp.

Pumps, Steam Driven.
Allis-Chalmers Mfg. Co.
Worthington P. & M. Corp.

Pumps, Vacuum.
Worthington P. & M. Corp.

Push Buttons.
Manhattan Electrical Supply Co.

Pyrometers.
Bristol Co., The.
Leeds & Northrup Co.

Rail Bonds.
American Steel & Wire Co.
Condit Electrical Mfg. Co.
General Electric Co.

Railways, Miniature.
Carlisle & Finch Co.

Ranges, Elec.
Cutler-Hammer Mfg. Co.
General Electric Co.

What Advertisers Offer to Readers

Classified Index of Products of Representative Manufacturers and Dealers Advertising in This Issue

Receptacles. (See Sockets.)

Rectifiers.
General Electric Co.

Reflectors.
Adams-Bagnall Electric Co.
General Electric Co.

Repairing.
Gregory Electric Co.
Nelson, I. R.

Resistance Units.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Elicon Co.
General Electric Co.
Industrial Controller Co.
Ward Leonard Electric Co.

Resistance Wire. (See Wires, Resistance.)

Rheostats.
Biddle, James G.
Campbell Electric Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Industrial Controller Co.
Monitor Controller Co.
Sundh Electric Co.
Ward Leonard Electric Co.

Rosettes.
General Electric Co.
Hart Mfg. Co.
National Metal Molding Co.

Rubber Covered Wire.
Roebling's Sons Co., J. A.

Searchlights.
Carlisle & Finch Co.
General Electric Co.

Second-hand Apparatus.
Andrén, Karl.
Archer & Baldwin.
Baldwin Co., R. S.
Carroll & Co., W. A.
Dixie Power Co.
Duquesne Elec. & Mfg. Co.
Dyar H. W.
Elliott Elec. Co.
Greensboro Supply Co.
Gregory Electric Co.
Harris Bros. Co.
Jones Mach. Co., K. L.
Kirchner, R. J.
Klein & Co., Nathan.
Louisville Gas & Elec. Co.
Lycoming Edison Co.
MacGovern & Co.
National Machry. & Wrecking Co.
Nelson, R. I.
New York Machry. Exchange.
Phillips & Co., A.
Power Machy. Exchange, Inc.
Ross Power & Equipment Co.
Salzberg & Co., H. E.
Scheinert Co., R.
Sachsenmaier & Co., Geo.
Schwartz & Land.
Sierra & San Francisco Power Co.
Steam & Elec. Mach'y Co.
Sun Power Equipment Co.
Thomas Elec. Repair Co.
Tiffany, Hall & Co., Inc.
Vinino Bros. & Co.
Wilson Machinery Co., H. R.

Separators, Magnetic.
Cutler-Hammer Mfg. Co.

Shade Holders.
Adams-Bagnall Electric Co.
General Electric Co.
Hubbell, Inc., Harvey.

Sheet Metal.
Am. Sheet & Tin Plate Co.

Sheets, Electrical.
Am. Sheet & Tin Plate Co.

Shovels, Pole Hole.
Matthews & Bro., Inc., W. N.

Signs.
Colonial Sign & Inc. Co.

Signs, Electric.
Colonial Sign & Ins. Co.

Sleeves, Splicing.
Elec'l Engineers Equipment Co.
Hatch, E. G.

Sockets and Receptacles.
Cutler-Hammer Mfg. Co.
General Electric Co.
Hart Mfg. Co.
Hubbell, Inc., Harvey.
National Metal Molding Co.

Sockets, Turndown.
General Electric Co.

Soldering Flux.
Allen Co., L. B.
Blake Signal & Mfg. Co.
Condit Electrical Mfg. Co.

Soldering Irons.
General Electric Co.

Soldering Outfits, Acetylene.
Prest-O-Lite Co., Inc.

Solenoids.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Ward Leonard Electric Co.

Special Machinery.
Torrington Mfg. Co.

Splicing Sleeves.
Frankel Connector Co., Inc.

Springs.
American Steel & Wire Co.
Cary Spring Works.
Cook Spring Co.

Stacks, Steel Smoke.
American Bridge Co.

Stage Lighting Apparatus.
Campbell Electric Co.
Condit Electrical Mfg. Co.

Staples.
American Steel & Wire Co.
Blake Signal & Mfg. Co.

Starters, Motor.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Sundh Elec. Co.
Ward Leonard Electric Co.

Stokers.
American Engineering Co.
Edge Moor Iron Co.
Green Eng'g Co.
Riley Stoker Co., Ltd., Sanford.

Stoves, Elec. (See Ranges, Elec.)

Sub-Station, Outdoor.
Delta Star Elec. Co.
General Electric Co.
Railway & Industrial Eng. Co.
Transmission Engr'g Co.

Supplies (Electric Railway.)
General Electric Co.
Ohio Brass Co.
Western Elec. Co.

Supplies, Electrical.
General Electric Co.
Manhattan Elecl. Supply Co.
Western Elec. Co.

Switchboard Supplies.
Condit Electrical Mfg. Co.
Elec'l Engineers Equipment Co.
General Electric Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.

Switchboards.
Allis-Chalmers Mfg. Co.
Anderson Mfg. Co., A. & J. M.
Condit Electrical Mfg. Co.
General Electric Co.
Roller-Smith Co.
Triumph Elec. Co.
Trumbull Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

Switchboard Panels.
Stone Base & Panel Co.

Switches, Automatic Time.
Anderson Mfg. Co., A. & J. M.

Switches, Disconnecting.
Anderson Mfg. Co., A. & J. M.
Elec'l Engineers Equipment Co.
Matthews & Bro., Inc., W. N.

Switches, Float.
Sundh Elec. Co.

Switches, Fuse.
General Electric Co.
Matthews & Bro., Inc., W. N.

Switches, Knife.
Anderson Mfg. Co., A. & J. M.
Condit Electrical Mfg. Co.
Cutter Co., The.
Electric Controller & Mfg. Co.
Elec'l Engineers Equipment Co.
General Electric Co.
Metropolitan Eng'g Co.
Palmer Elec. & Mfg. Co.
Trumbull Elec. & Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Worcester Elec. & Mfg. Co.

Switches, Oil.
Condit Electrical Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Switches, Pole Top.
Delta-Star Elec. Co.
Elec'l Engineers Equipment Co.
General Electric Co.
General Elec. Co., Ltd., of Great Britain.
K. P. F. Elec. Co.
Railway & Industrial Eng. Co.

Switches, Remote Control.
Anderson Mfg. Co., A. & J. M.
Cutler-Hammer Mfg. Co.
General Electric Co.
General Elec. Co., Ltd., of Great Britain.
Hart Mfg. Co.
Sundh Elec. Co.

Switches, Series.
G & W Elec. Specialty Co.

Switches, Snap and Push Button.
Cutler-Hammer Mfg. Co.
General Electric Co.
General Elec. Co., Ltd., of Great Britain.
Hart Mfg. Co.
Trumbull Elec. Mfg. Co.

Switches, Time.
Campbell Electric Co.
Hartford Time Switch Co.
Paragon Electric Co.

Tachometers.
Biddle, James G.
Bristol Co., The.
Foxboro Co., The.
Roller-Smith Co.

Taps & Dies.
Carpenter Tap & Die Co., J. M.

Telephone Service.
American Tel. & Tel. Co.

Telephones.
Manhattan Elec'l Supply Co.
Western Elec. Co.

Testing Apparatus.
American Transformer Co.
Biddle, James G.
Leeds & Northrup Co.
Roller-Smith Co.

Testing Laboratories.
Elecl. Testing Laboratories.
Leeds & Northrup Co.

Theatre Dimmers.
Cutler-Hammer Mfg. Co.
General Electric Co.
General Elec. Co., Ltd., of Great Britain.
Industrial Controller Co.
Ward Leonard Electric Co.

Thermometers.
Bristol Co., The.
Foxboro Co., The.
Leeds & Northrup Co.

Tools, Construction.
Klein & Sons, Mathias.

Tools, Linemen's.
Klein & Sons, Mathias.
Western Elec. Co.

Tools, Portable Elec.
Chicago Pneumatic Tool Co.

Tools, Underground Conduit.
Cope, T. J.

Towers, Transmission.
American Bridge Co.
Archbold-Brady Co.
Bates Exp. Steel Truss Co.
Blaw Steel Cons. Co.
Coombs, R. D.
Railway & Industrial Eng. Co.
Transmission Eng'g Co.

Transformers.
Adams-Bagnall Elec. Co.
Allis-Chalmers Mfg. Co.
American Transformer Co.
Campbell Electric Co.
Crocker-Wheeler Co.
Duncan Elec. Mfg. Co
Enterprise Electric Co.
Kuhlman Elec. Co.
Metropolitan Eng'g Co.
Moloney Elec. Co.
Pittsburgh Transformer Co.
Thordarson Elec. Mfg. Co.
Triumph Elec. Co.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Ins. Co.

Transformers, Bell Ringing.
General Electric Co.
Pittsburgh Transformer Co.
Westinghouse Elec. & Mfg. Co.

Turbines, Steam.
Allis-Chalmers Mfg. Co.
General Electric Co.
Moore Steam Turbine Corp.
Ridgway Dynamo & Eng. Co.

Vacuum Cleaners.
Western Electric Co.

Valve Discs.
Diamond State Fibre Co.
Jenkins Bros.
Ohio Brass Co.

Valves.
Jenkins Bros.
Nelson Valve Co.
Ohio Brass Co.
Richardson-Phenix Co.

Valves, Pumps.
Jenkins Bros.

Valves, Superheated Steam.
Richardson-Phenix Co.

Vehicles, Elec.
General Vehicle Co.
Ward Motor Vehicle Co.

Vibrators.
Shelton Elec. Co.
Thordarson Elec. Mfg. Co.

Washing Machines, Electric.
Western Elec. Co.

Water Wheels and Turbines.
Allis-Chalmers Mfg. Co.
Leffel & Co., James.
Morris Co., I. P.
Smith Co., S. Morgan.
Trump Mfg. Co.

Water Wheel Governors.
Lombard Governor Co.
Woodward Governor Co.

Waterproofing.
Mitchell-Rand Mfg. Co.

Wattmeters, Watt-Hour Meters. (See Instruments, Electrical.)

Welding Apparatus.
Lincoln Electric Co.

Weatherproof Wire.
Prest-O-Lite Co., Inc.
Roebling's Sons Co., J. A.

Winding Machines.
New England Butt Co.

Wire, Copper Clad.
Page Woven Wire Fence Co.

Wires, Resistance.
Driver-Harris Wire Co.
Electrical Alloy Co.

Wires and Cables.
Acme Wire Co.
Amer. Brass Co.
Amer. Electrical Works.
Amer. Steel & Wire Co.
Atlantic Ins. Wire & Cable Co.
Belden Mfg. Co.
Benedict & Burnham Mfg. Co.
D & W Fuse Co.
Driver-Harris Wire Co.
General Electric Co.
Independent Lamp & Wire Co.
Indiana Rub. & Ins. Wire Co.
Kerite Ins. Wire & Cable Co.
Lowell Ins. Wire Co.
Massachusetts Elec. Mfg. Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Page Woven Wire Fence Co.
Roebling's Sons Co., J. A.
Rome Wire Co.
Safety Ins. Wire & Cable Co.
Simplex Wire & Cable Co.
Trumbull Elec. Mfg. Co.
Western Elec. Co.

Wood, Pipe.
National Tank & Pipe Co.
Portland Wood Pipe Co.
Washington Pipe & Foundry Co.

X-Ray Apparatus.
Campbell Electric Co.

ALPHABETICAL INDEX TO ADVERTISEMENTS

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Printing begins on Friday preceding week of issue.
Changes of copy received up to Friday will appear in the issue of the following week, but no proofs can be submitted for OK before publication.
New Advertisements (not changes of copy) received up to Wednesday 10 A. M. can usually appear in the issue of that week, but no proofs can be shown.
If proofs before printing are required, changes of copy and copy for new advertisements must be in our hands 10 days in advance of the date of publication.

Abbott, Jr., W. G. 36
Acme Die-Casting Corp. 77
Acme Wire Co. 65
Adams-Bagnall Electric Co. 57
Allen Co., L. B. 75
Allis-Chalmers Mfg. Co. 57
Aluminum Co. of America 45, 70
American Brass Co. 70
American Bridge Co. 27
American Carbon & Battery Co. . 68
American Circular Loom Co. ... 62
American District Steam Co. ... 36
American Electrical Works .....BC
American Engineering Co. 80
American Insulating Mchy. Co. . 75
American Sheet & Tin Plate Co. 72
American Steel & Wire Co. 72
American Tel. & Tel. Co. 58
American Transformer Co. 73
American Vulcanized Fibre Co. . 61
Anderson Mfg. Co., A. & J. M. . 76
Andrên Co., Karl. 42
Archbold-Brady Co. 64
Archer & Baldwin. 39
Arnold Co. 36
Atlantic Ins. Wire & Cable Co. . 72
Automatic Reclosing Circuit Breaker Co. 75

Babcock & Wilcox Co. 76
Baehr, William A. 36
Baker & Co., Inc. 75
Baldwin Co., R. S. 46
Barstow Co., W. S. 36
Bates Expanded Steel Truss Co. 65
Baum, F. G. 36
Beckman & Linden Eng. Corp. . 36
Belden Mfg. Co. 65
Benedict & Burnham Mfg. Co. . 70
Biddle, James G. 67
Blake Signal & Mfg. Co. 73
Blaw Steel Const. Co. 69
Boston-Economy Lamp Div. 74
Bristol Co. .....BC
Brookfield Glass Co. 66
Bruce-Macbeth Engine Co. 78
Burke Electric Co. 67
Byllesby & Co., H. M. 36

Cameron Electric Mfg. Co., The. 76
Campbell Electric Co. 66
Card Index 37
Carney & Co., B. J. 73
Carlisle & Finch Co., The. 71
Carpenter Tap & Die Co., J. M. . 71
Carrel & Co., W. A. 39
Cary Spring Works. 76
Century Elec. Co. 64
Chicago Elec. Lamp Co. 73
Chicago Fuse Mfg. Co. 62
Chicago Pneumatic Tool Co. 78
Clemens Elec'l Corp. 83
Coal and Iron National Bank 74
Colonial Sign & Ins. Co. 74
Condit Electrical Mfg. Co. 9
Consolidated Elec. Lamp Co. 69
Continental Fibre Co. 74
Cook Spring Co. 74
Coombs, R. D. 36
Cooper, Hugh L. 36
Cope, T. J. 72
Cravath, J. R. 36
Crocker-Wheeler Co. 74
Cutler-Hammer Mfg. Co. 19
Cutter Co., The. 29

D & W Fuse Co. 14
Day & Zimmermann. 36
Daum, A. F. 70
Delta Star Electric Co. 73
Diamond State Fibre Co. 75
Diehl Mfg. Co. 59
Directory of Engineers. 36, 37
Dixie Power Co. 44
Doehler Die-Casting Co. 78
Driver-Harris Co. 83
Duncan Elec. & Mfg. Co. 53
Duquesne Elec. & Mfg. Co. 39
Dyar, H. W. 46

Economy Fuse & Mfg. Co. 22
Edge Moor Iron Co. 78
Edison Storage Battery Co. 18
Electric Bond & Share Co. 68
Electric Controller & Mfg. Co. . 74
Electric Fuseguard Co. 73
Electric Machinery Co. 76
Electric Storage Battery Co. 68
Electrical Alloy Co. 75
Electrical Engrgs. Equipment Co. 24
Elec'l Testing Laboratories. .36, 55
Electrical World 3
Electro-Dynamic Co. 76
Ellcon Co. 55
Elliott Electric Co. 46
Emerson Elec. Mfg. Co. .....BC
Engineers, Directory of. 36, 37
Enterprise Electric Co. 64
Erie City Iron Works. 80
Eureka Co., The. 76
Eyer, B. F. 36

Fargo Engineering Co. 36
Ferracute Machine Co. 77
Fibre Conduit Co. 20
Ford, Bacon & Davis. 36
Fowle, Frank F. 36
Foxboro Co., The. .....BC
Frankel Connector Co., The. 62

G & W Elec. Spec. Co. 25
Gannett, Seelye & Fleming. 36
General Elec. Co. 30-33
General Engrg. & Mngmt. Corp. . 36
General Vehicle Co. 15
Gest, G. M. 72
Graves Engineering Co., Inc. 36
Green Engineering Co. 76
Green Fuel Economizer Co. 77
Greensboro Supply Co. 40
Gregory Electric Co. 38
Gurney Ball Bearing Co. 67

Harris Bros. Co. 41
Hart Mfg. Co. 74
Hartford Time Switch Co. 63
Hatch, E. G. 36
Hatch, James N. 36
Hayward Co. 77
Hemingray Glass Co. 70
Hemming Mfg. Co. .....BC
Hubbard & Co. 26
Hubbell, Harvey, Inc. 69
Hunt Co., Inc., C. W. 79
Hygrade Lamp Co. 74

Imperial Porcelain Works. 75
Independent Lamp & Wire Co., 54, 67
Indiana Rub. & Ins. Wire Co. .. 34
Industrial Controller Co. 74
Irving-Pitt Mfg. Co. 63
Irvington Varnish & Insulator Co. 12

Jackson, D. C. & W. B. 36
Jeandron, W. J. 69
Jenkins Bros. .....BC
Jones Mach'y Co., K. L. 44

Keene Mica Products Co. 73
Kerite Insulated Wire & Cable Co. 34
Kimble Electric Co. 55
Kirchner, R. J. 46
Klein & Co., Nathan. 44
Klein & Sons, Mathias. 73
K-P-F. Elec. Co. 70
Kuhlman Elec. Co. 71

Lapp Insulator Co., Inc. 74
Le Carbone Co. 69
Leeds & Northrup Co. 56
Leffel & Co., James. 79
Light & Development Co. of St. Louis 36
Lincoln Electric Co. 84
Locke Insulator Mfg. Co. 53
Lombard Governor Co. 76
Louisville Gas & Elec. Co. 45
Lowell Ins. Wire Co. 72
Lux Mfg. Co. 69
Lycoming Edison Co. 46

MacGovern & Co. 40
Manhattan Electrical Supply Co. 70
Marchant Calculating Mach. Co. 59
Maris Bros. 76
Massachusetts Elec. Mfg. Co. ....BC
Matthews Bro., Inc., W. N. .21, BC
McGraw-Hill Book Co., Inc. 60
McIntosh & Seymour Corp. 77
McLennan & Co., K. 76
McMeen & Miller. 36
Mead, Daniel W. 36
Mershon, Ralph D. 36
Metropolitan Eng. Co. 29
Mitchell-Rand Mfg. Co. 73
Moloney Electric Co. 52
Monitor Controller Co. 74
Moore & Co., W. E. 37
Moore Steam Turbine Corp. 76
Morgan Crucible Co. 61
Morris Co., I. P. 28
Morse Bros. Machinery & Supply Co. 39
Multi-Refillable Fuse Co. .....BC
Munsell & Co., Eugene. 72

National Lamp Works 10, 11
National Machy. & Wrecking Co. 42
National Metal Molding Co. 52
National Pipe Bending Co. 77
National Tank & Pipe Co. 78
National Tube Co. 73
Neall, N. J. 37
Neiler, Rich & Co. 37
Nelson, I. R. 43
Nelson Valve Co. 60
New England Butt Co. 70
New Process Gear Corporation. . 77
New York Ins. Wire Co. .....BC
New York Machy. Exchange. 40
Norma Co. of America. 71
Norton, Bird & Whitman. 37

Ohio Brass Co. 75
Okonite Co. 34
Ophüls, Hill & McCreery. 37
Orangeburg Fibre Conduit Co. .. 20
Oshkosh Mfg. Co. 64

Page Woven Wire Fence Co. 75
Palmer Elec. & Mfg. Co. 27
Paragon Elec. Co. 63
Parker & Son, J. H. 73
Phillips, Leo A. 41
Pignolett, L. M. 75
Pittsburgh High Voltage Ins. Co. 66
Pittsburgh Transformer Co. 73
Portland Wood Pipe Co. 76
Power Machinery Exchange, Inc. 42
Press, A. 37
Prest-O-Lite Co., Inc. 71
Publishers' Page 86

Radtke, Albert A. 37
Railway & Industrial Engrg. Co. 56
Randle Machinery Co. 42
Read-Dresser Eng. Co. 37
Redmanol Chemical Products Co. 71
Reed, W. Edgar. 37
Reliance Elec. & Eng. Co. 77
Richardson-Phenix Co. 77
Ridgway Dyn. & Eng. Co. 80
Riley Stoker Co., Sanford. 78
Robbins & Myers Co. 35
Roebling's Sons Co., John A. 73
Roller-Smith Co. 28
Rome Wire Co. .....BC
Ross Power & Equipment Co. 44
Roth Bros. & Co. 77
Rutherford & Uptegraff. 37
Ryle & Co., Wm. 75

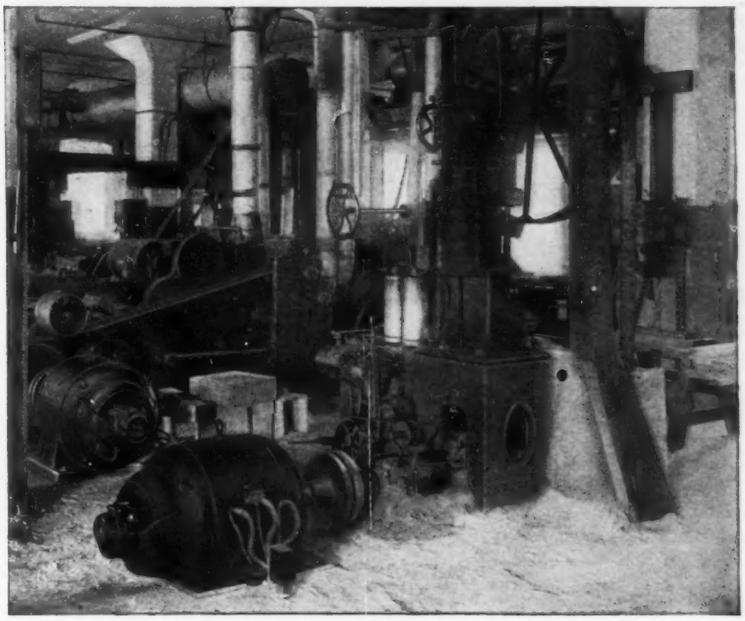
S K F Ball Bearing Co. 69
Sachsenmaier & Co., Geo. 45
Safety Ins. Wire & Cable Co. .. 75
Salzberg & Co., H. E. 46
Samson Cordage Works. 73
Sanderson & Porter. 37
Sangamo Elec. Co. 70
Sargent & Lundy. 37
Scheidenhelm, F. W. 36
Scheinert, R. 43
Schwartz & Land. 46
Schweitzer & Conrad, Inc. 74
Scofield Eng'g Co. 37
Searchlight Section 38-50
Shelton Electric Co. 76
Sherwin-Williams Co. 65
Sierra & San Francisco Power Co. 45
Simplex Wire & Cable Co. 34
Smith Co., S. Morgan. 80
Smith-Serrell Co., Inc. 77
Sothman Corp. 37
Spaulding & Sons Co., J. 68
Sprague Electric Works. 58
Spray Engineering Co. 79
St. Louis Elec'l Works. 78
Standard Woven Fabric Co. 74
States Company 69, 72
Steam & Elec. Machy. Co. 41
Steward Mfg. Co., D. M. 75
Stone Base & Panel Co. 66
Stone & Webster Eng'g Corp. .. 37
Sun Power Equipment Co. 46
Sundh Electric Co. 63
Swett Iron Works, A. L. 62

Texas Company 85
Thomas & Sons Co., R. 71
Thomas, Percy H. 37
Thomas Elec. Repair Co. 44
Thordarson Elec. Mfg. Co. 75
Tiffany, Hall & Co., Inc. 43
Toomey, Inc., Frank. 42
Torrington Mfg. Co. 74
Transmission Engrg. Co. 56
Triumph Elec. Co. 78
Trumbull Electric Mfg. Co. 71
Trump Mfg. Co. 77
Tubular Woven Fabric Co. 77

Underwriters Laboratories, Inc. . 37
Venino Bros. & Co. 43

Wagner Elec. Mfg. Co. 91
Ward Leonard Elec. Co. 13
Ward Motor Vehicle Co. 16, 17
Washington Pipe & Fdy. Co. 79
Western Electric Co. .....8, FC
Wells, James P. 37
Western Red Cedar Assn. 23
Westinghouse Elec. & Mfg. Co. .. 4-7
Weston Electrical Instrument Co. 2
White Companies, J. G. 37
Williams, Gardner S. 37
Wilson Machinery Co., H. R. 39
Woodmansee & Davidson. 37
Woodward Governor Co. 76
Worcester Elec. & Mfg. Co. 75
Worthington Pump & Machinery Co. 82

Saving in first cost on Polyphase Motors



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497

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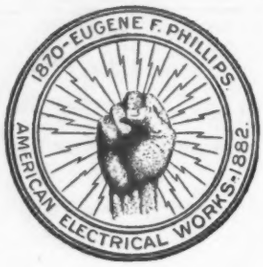

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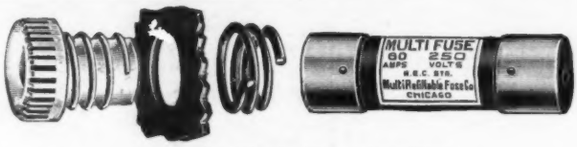

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